Unit Title: Genetics

Duration:
Chloe's subunit (6x50 min blocks)
Brittany's subunit (3x90 min blocks)
Sam's subunit (4x90 min blocks)
Jon's subunit (3 x 67 min class)

Overview/Description:
In this unit, students will explore how the structure of DNA allows it to function as the basis of heredity. Students will go on to learn about how DNA is organized into genes that are translated into proteins, and how these genes are passed from parent to offspring. Various types of heredity will be investigated, including both Mendelian and Non-Mendelian inheritance patterns. Students will finish their discovery of genetics by studying various genetic disorders.

Rationale for Unit
Students will gain an understanding of how genetic information (DNA) impacts physical traits, and the various ways in which genetic information can be passed from generation to generation. A focus will be placed on how genetically-inherited disorders are perpetuated. Knowledge of human genetics will allow students to construct an understanding of how their own genetic traits are expressed, and make inferences about how genes are expressed and inherited in other populations. The study of genetics will afford students a greater understanding of the world they live in, and allow them to formulate informed opinions about controversial topics, such as genetic engineering.

Links to GSEs

- 01 Chloe Robitaille Content Standard 2a 01.4 Res Chloe Robitaille- GSEs
- 02 Chloe Robitaille Content Standard 2cc 01.4 Res Chloe Robitaille- GSEs
- 03 Chloe Robitaille Content Standard 2c, 2cc 01.4 Res Chloe Robitaille- GSEs
- 09 Sam Barrus Content Standard-2b
- 07/08 Sam Barrus Content Standard-7b
- 10.5 Jon Brown, Link to standards for first lesson
- LS3 (9-11) 7
- 11.6 Jon Brown, Link to standards for second lesson
- 011 Jon Brown LS1 (9-11) 2b + 2aa
- 12.4 Jon Brown, Link to standards for third lesson
- 012 Jon Brown LS1 (9-11) 2b + 2c + 2aa
-
- **Driving Question for Unit:**

How do your genes impact your life?

Graphical Representation of Topics and Subtopics

Standards and Concept Map 10/28

Planning Grids

Week # or Dates	Link to Planning Calendar	Driving Sub-Question
1	Chloe Robitaille Weekly Planning Guide	How does the genetic code work to create proteins that make up our bodies? Learning Goal: Understand DNA as the basis of heredity.
2		How did Mendel's work contribute to our current understanding of

		modern genetics?
3	Weekly Planning Organizer (#3)- Sam Barrus- Beyond Mendel	What was discovered about genetic variation after Mendel's time?
4	12.4 Jon Brown, Weekly Schedule	What is a genetic disorder and how can we identify them?

Lessons

Day / Date	Author	Lesson Title (include a link to lesson plan)	Brief Description of Lesson
1,2	Chloe R	01 LP Chloe Robitaille- DNA Model Building Competition	Students compete in teams to create models of the DNA double helix. Two 50 min periods.
3	Chloe R	02 LP Chloe Robitaille- Transcription, LIVE!	Students act out the process of transcription, each student is assigned the role of a specific nucleotide or the enzyme, RNA Polymerase. Students complete a Venn Diagram as a class to compare and contrast DNA and RNA. One 50 min period.
4-6	Chloe R	03 LP Chloe Robitaille- Synthesizing Synthesis, In-class Project	Students create their own explanations of the process of protein synthesis as an in-class project. Students work in pairs and have a choice of creating a poster, animation or live simulation. Concept map assigned for homework. Three 50 min periods.
7	Britt B	04.0 Brittany Barlow Mendel's Basics	Opening poll with powerpoint lecture giving the background of Mendel's work with key vocabulary. Class inputs data into poll as a whole. Class answers questions about dominant and recessive traits.Homework on inherited traits vs non inherited traits.
8	Britt B	05.0 Brittany Barlow Genotype and Phenotype	Vocab quiz. Powerpoint on the law of segregation and assortment, phenotype and genotype. Finish worksheet as a class. Start an activity where you create your own dog using DNA. Finish for HW. One page HW on alleles.
9	Britt B	06.0 Brittany Barlow Punnet Squares	Quiz on alleles. Powerpoint on punnet squares. Students complete activity where they create their own punnet squares using dragons.
10	Sam B.	07 LP Sam Barrus- Neither Dominant nor	Begin learning about the spectrum of dominance after Mendelian genetics. Complete lab to understand non-mendelian ratios of expression and

		Recessive: Alternate Forms of Dominance	their origin through sample populations of gummy bears.
11-12	Sam B.	08 LP Sam Barrus-Gene Interaction and Linkage	Introduction to the work of Thomas H. Morgan and continuing on concepts related to non-Mendelian genetics. Students research a term and create a study sheet for a given concept/term to explain to the class in a discussion format next period while generating a notes sheet together.
13	Sam B.	09 LP Sam Barrus-Epigenetics	Genetics Bingo! Explore epigenetics through photo set, video on identical twins, interactive module, and guiding questions. Summation of Beyond Mendel subunit.
14	Jon B.	10 LP Jon Brown-Piecing Together Pedigrees	Review of past concepts. PowerPoint introduction to pedigrees. Two class worksheets done in pairs.
15	Jon B	11 LP Jon Brown-Creating Karyotypes	Students will review what they know about chromosomes before watching a short hook video. A PowerPoint on Karyotypes will be given. Students will then partner up and create a karyotype for classwork.
16	Jon B	12.0 LP Jon Brown-Diagnosing Genetic Disorders	Class will start with a class discussion asking how they liked (or disliked) the online assignment from homework. Then a short hook video will be shown, followed by a PowerPoint on Genetic Disorders. The rest of class time will be spent working on a three part assignment.

Homework Guide

- **Sam Barrus Homework Planner**
- 12.5 Jon Brown Homework Planner
- Brittany Homework Planner

Links to Assessment Items

- Final Assessment
-

01 LP Chloe Robitaille- DNA Model Building Competition

Overview

The following lessons take place in a high school biology class of college-preparatory level 11thgraders. These students are beginning a unit on Genetics and have just completed an introductory lesson introducing them to the experiments of Avery, Griffiths, and Hershey and Chase. This introductory lesson has provided them with foundational information about DNA and the understanding that DNA is the molecule of heredity. In the following lesson, students will compete in teams to build models of a DNA helix. Students will then discuss the strengths and shortcomings of their models in light of new information about the DNA molecule and learn about the process of DNA replication. This lesson takes place over multiple 50 minute class periods.

Standards (Links)

GSEs: 2a01.4 Res Chloe Robitaille- GSEs

NGSS: HS-LS1-101.3 Res Chloe Robitaille- NGSS

Objectives

Students will be able to...
1. construct a model of DNA using candy, which appropriately demonstrates the double-stranded, helical nature of the molecule, as well as proper pairing of the nitrogenous bases.

Materials / Preparation Notes

-competition handout01.1 Res Chloe Robitaille- Competition Rules

-animationhttp://www.youtube.com/watch?v=J2BzrA5IWtY

-building competition materials:

-gumdrops

-marshmallows

-twislers (both kinds)

-toothpicks

-skewers

-nerd rope

-exit slips01.2 Res Chloe Robitaille- Exit Slip

Instruction

Students were divided into their competition teams and given the handout detailing the competition rules and regulations at the end of the previous class. Students were instructed to look over the rules and begin to think of how they will build their models, but they have not been told what their materials are.

Opening

-play "the Candyman" by Sammy Davis, Jr in the background

-Ask students what their initial plans were, what materials they had hoped for

-Discuss what characteristics of DNA should be shown in the models (double-stranded, helix, base-pairing, distinction between nitrogenous bases and sugar-phosphate backbone)

-reveal materials (candy bowls) and tell them that they may use anything in the bowls to represent any part of the molecule, but that they should choose carefully because they will be responsible for defending their choices at the judging portion of the competition. Each student on the team must "defend" at least one candy choice.

Activities

Begin competition. Students build for whole class period. Teacher circulates around the room, observing, but does not give building advice. Teacher may encourage less-outspoken group members to get involved. Teacher also advises students to keep a written record of their "candy-choice defense" to share when they present their model for judging.

At the beginning of next class, have each group share their models with the class. Then have students vote on which model they think will win. The teacher, or official judge, reveals their choice for winner and explains the features of the model that made it the winner (e.g. accurate base pairing, use of different candies for adenine and thymine vs guanine and cytosine to show appropriate Hydrogen bonding, etc.) This portion should take approximately 20 minutes.

After winner has been decided, invite students to eat the left over candy and discuss their models. Ask students for their attention, remove a "base pair" candy from a model and replace it with a different color. Ask students what has just occurred. Explain that you have created a mutation and ask students to predict what impact this may have.

Ask students if they noticed anything about the ratios of candy they used. Use this to introduce Chargaff's Rules and have students add Chargaff's Rules to their notes.

Inform students we will wrap up the day by discussing how DNA is replicated. Ask students for their ideas about how this might be done. Prompt them by asking them if I took away one side of their model, would they know how to re-build it?

Show short animation and pass out exit slips.

Closing

Collect exit slips and inform students that since they now have an understanding of the structure and replication of DNA, we will begin to look at how our DNA determines how our bodies look and function.

Assessment Notes

Correct any misconceptions relayed on the exit slips at the beginning of the next class. Share the most common and most relevant answers with students next class.

01.1 Res Chloe Robitaille- Competition Rules

DNA Model Building Competition

Rules and Regulations:

1. Models must be constructed within one 50 minute class period.
2. Models may only be constructed with provided building materials. A maximum of 20 units of each type of building material may be used.
3. Models must be no larger than the area of one desk.

4. Alterations to the building materials ARE allowed (i.e. you may fold, carve, cut, etc.)
5. Models must be constructed by teams no larger than 3 people. You must work with your assigned team.
6. The winning model will be determined by the official competition judge, Ms. Robitaille.
7. Teams will be given no longer than 5 minutes to show their model to the judge and explain their building choices. Each member of the team must speak at this time.
8. The winning team will receive +5 points on their unit assessment.
9. Creativity and attention to detail will factor into the judge's score for your model.
10. An ideal model should demonstrate:

    -the helical nature of the DNA molecule

    -double strands

    -the make-up of the sugar-phosphate backbone

    -the 4 different nitrogenous bases

    -the base pairing between Adenine & Thymine and Guanine & Cytosine

01.2 Res Chloe Robitaille- Exit Slip

Slip

NAME:

Name at least 3 key features of DNA.

1.

2.

3.

01.3 Res Chloe Robitaille- NGSS

HS.Structure and Function

HS.Structure and Function

Students who demonstrate understanding can:

HS-LS1-1. **Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.** [Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.]

HS-LS1-2. **Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.** [Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.]

HS-LS1-3. **Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.** [Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.] [Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Developing and Using Models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world.

- Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2)

Planning and Carrying Out Investigations

Planning and carrying out in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-LS1-3)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1-1)

Disciplinary Core Ideas

LS1.A: Structure and Function

- Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)
- All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1) *(Note: This Disciplinary Core Idea is also addressed by HS-LS3-1.)*
- Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)
- Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3)

Crosscutting Concepts

Systems and System Models

- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. (HS-LS1-2)

Structure and Function

- Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-LS1-1)

Stability and Change

- Feedback (negative or positive) can stabilize or destabilize a system. (HS-LS1-3)

01.4 Res Chloe Robitaille- GSEs

Rhode Island K-12 Grade Span Expectations in Science
Life Science

LS1 - All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).					
LS1 (K-4) SAE -2 *Identify the basic needs of plants and animals in order to stay alive. (i.e., water, air, food, space).*		***LS1 (5-8) SAE+FAF –2*** *Describe or compare how different organisms have mechanisms that work in a coordinated way to obtain energy, grow, move, respond, provide defense, enable reproduction, or maintain internal balance (e.g., cells, tissues, organs and systems).*		***LS1 (9-11) FAF+ POC -2*** *Explain or justify with evidence how the alteration of the DNA sequence may produce new gene combinations that make little difference, enhance capabilities, or can be harmful to the organism (e.g., selective breeding, genetic engineering, mutations).*	
Grade Span Expectations (K-4)		**Grade Span Expectations (5-8)**		**Grade Span Expectations (HS)**	
LS1 (K-2)-2 **Students demonstrate understanding of structure and function-survival requirements by…** **2a** observing that plants need water, air, food, and light to grow; observing that animals need water, air, food and shelter to grow.	**LS1 (3-4)-2** **Students demonstrate understanding of structure and function-survival requirements by…** **2a** observing that plants need water, air, food, light and space to grow and reproduce; observing that animals need water, air, food, and shelter/space to grow and reproduce.	**LS1 (5-6) – 2** **Students demonstrate understanding of structure and function-survival requirements by…** **2a** describing structures or behaviors that help organisms survive in their environment (e.g., defense, obtaining nutrients, reproduction, and eliminating waste).	**LS1 (7-8) – 2** **Students demonstrate understanding of structure and function-survival requirements by…** **2a** explaining how the cell, as the basic unit of life, has the same survival needs as an organism (i.e., obtain energy, grow, eliminate waste, reproduce, provide for defense). **2b** observing and describing (e.g., drawing, labeling) individual cells as seen through a microscope targeting cell membrane, cell wall, nucleus, and chloroplasts. **2c** observing, describing and charting the growth, motion, responses of living organisms	**LS1 (9-11) –2** **Students demonstrate an understanding of the molecular basis for heredity by …** **2a** describing the DNA structure and relating the DNA sequence to the genetic code. **2b** explaining how DNA may be altered and how this affects genes/heredity (e.g. substitution, insertion, or deletion). **2c** describing how DNA contains the code for the production of specific proteins.	**Example Extension(s)** **LS1 (Ext) –2** **Students demonstrate an understanding of the molecular basis for heredity by …** **2aa** diagramming or modeling the relationship between chromosomes, genes and DNA, including histones and nucleosomes. **2bb** describing the how foods are genetically modified and the potential health, environmental and economic advantages and disadvantages of doing so. **2cc** tracing in a diagram or model the information flow - DNA to RNA to Protein - through transcription and translation.

02 LP Chloe Robitaille- Transcription, LIVE!

Overview

In this 50 minute lesson, students will act out the process of transcription and compare DNA and RNA.

Standards (Links)

GSEs: 2cc01.4 Res Chloe Robitaille- GSEs

NGSS: HS-LS1-101.3 Res Chloe Robitaille- NGSS

Objectives

Students will be able to...
1. compare and contrast DNA molecules with RNA molecules, citing their 3 key differences.
2. predict the correct mRNA sequence resulting from transcription when given the DNA template strand.

Materials / Preparation Notes

-stanford protein synthesis dancehttp://www.youtube.com/watch?v=u9dhO0iCLww

-Venn Diagram handout02.1 Res Chloe Robitaille- Venn Diagram

- ~20 nucleotide identification bibs (a colored paper with a string attached so student can wear the paper around their neck). There should be: 1 or RNA polymerase bib, 3 red dna guanine bibs, 3 green dna cytosine bibs, 3 yellow dna adenine bibs, 3 purple thymine bibs, 2 red rna guanine bibs, 2 blue uracil bibs, 1 green rna cytosine bib, 1 yellow rna adenine bib02.2 Res Chloe Robitaille- Sample Nucleotide Bib

-exit slips02.3 Res Chloe Robitaille- Exit Slip

Instruction

All materials will be passed out and waiting on student's desk as they arrive to class.

Opening

The Stanford protein synthesis dance will be playing on the projector as students file into class. I will pause the video to discuss what was accomplished last class and any problems with student's exit slips. I will go on to explain that since we have formulated an understanding of the structure of DNA and how it replicates itself, we will now explore how DNA is transcribed into RNA, which is then translated into the proteins that build our bodies. I will then bring the student's attention back to the video and explain that we will be participating in a similar activity and that everyone can find their role in the demonstration on their desk.

Activities

-Set up the "DNA nucleotides" (six students) in a line as follows: GTCTAG
-have the remaining DNA nucleotides (six remaining "dna" students) complete the molecule by matching up with their corresponding base pair
-Tell the students we will now begin transcription. The person assigned the role of RNA polymerase has the most important job. They must "unzip" the DNA helix and match the DNA bases to corresponding RNA nucleotides. Explain that base pairing works the same way in transcription as it does in DNA replication, except that instead of T pairing with A, the RNA nucleotide U pairs with A.
-run through the demonstration several times, allowing students to switch roles and rearranging the order of the beginning DNA sequence

After around 15 minutes of acting out transcription, have students return to their seats and take out the Venn Diagram handout. Begin discussion comparing DNA to RNA. Make sure the difference in sugar, # strands and Uracil vs. Thymine are all brought up. Prompt students with questions about how many people were needed to signify DNA versus RNA in the simulation, how many different colored bibs there were and why, and what DNA and RNA stand for. Complete overhead copy of the diagram as students give answers. Make copies of completed diagram and pass out to students needing accommodations at the start of the next class period.

Closing

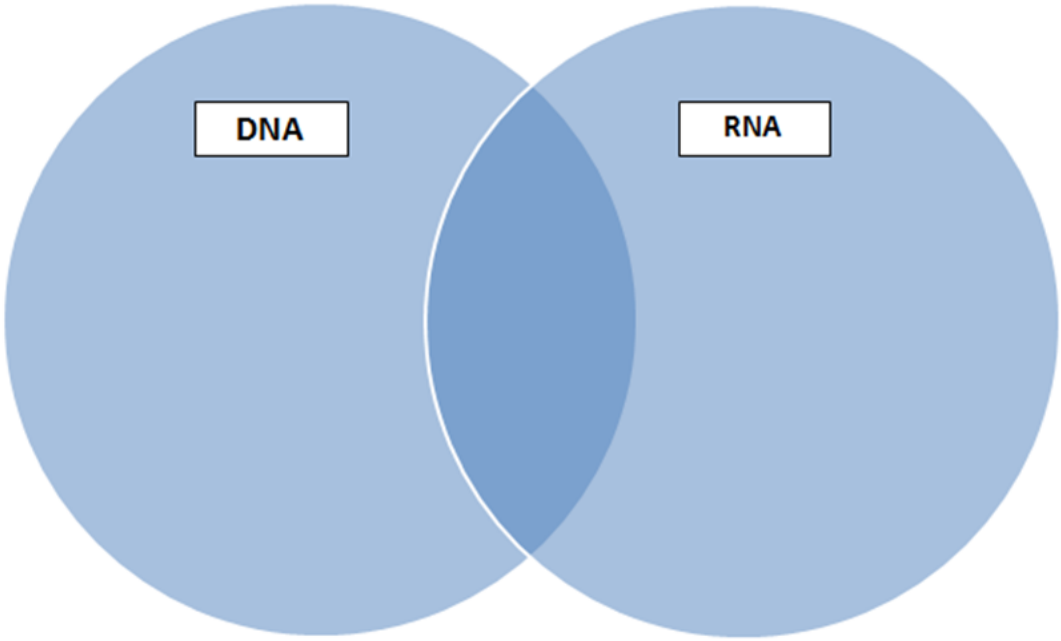
With 10 minutes remaining in the period, have students put away their diagrams and begin new discussion topic. "What is the point of transcription?" Some necessary prompts may be: "what is the role of DNA, RNA?", "the same strand of DNA is often transcribed into RNA hundreds of times, why?"

Pass out exit slips and have students complete them individually. Collect slips as students exit the room.

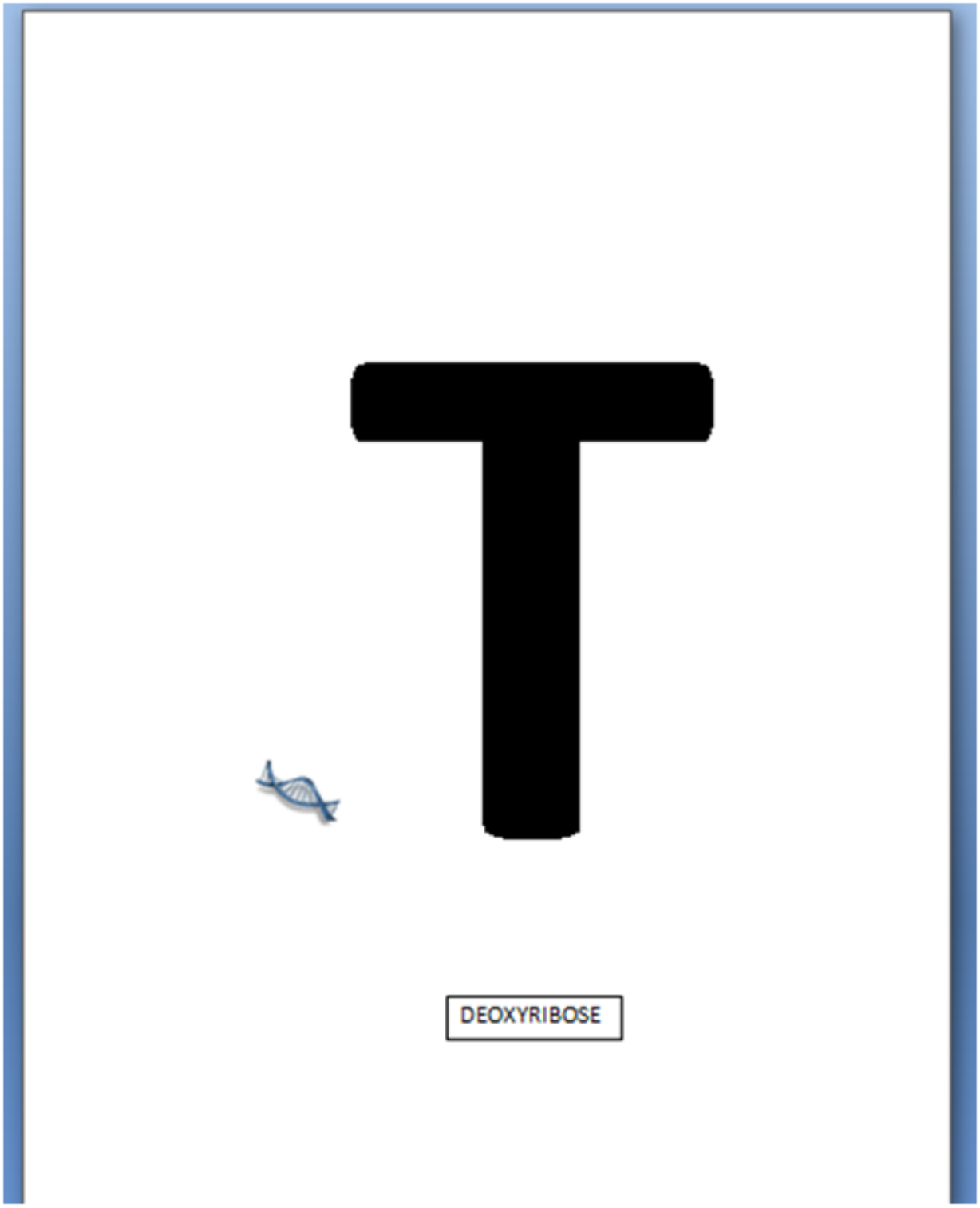
Assessment Notes

Check accuracy of exit slip to make a formative assessment about student's understanding of transcription.

02.1 Res Chloe Robitaille- Venn Diagram



02.2 Res Chloe Robitaille- Sample Nucleotide Bib



02.3 Res Chloe Robitaille- Exit Slip

Slip

NAME:

What is the mRNA sequence that will be transcribed from the following sequence of DNA?

DNA: TACTGCCAGT

RNA:

03 LP Chloe Robitaille- Synthesizing Synthesis, In-class Project

Overview

In this 3 period lesson, students will complete an open-ended in-class project on translation. Instead of direct instruction on the process, students will be given time in class to view animations and read explanations in the text. Students will then pair off and create an informational poster, animation, or live simulation to explain the process of protein synthesis. Students are already familiar with working with the I-pad applications, so no instructional time should be spent explaining how to use these.

Standards (Links)

GSEs: 2c, 2cc01.4 Res Chloe Robitaille- GSEs

NGSS: HS-LS1-101.3 Res Chloe Robitaille- NGSS

Objectives

Students will be able to...
1. produce an artistic representation of the process of transcription.
2. accurately explain the importance of the role of protein synthesis in the human body.
3. accurately identify the roles of DNA and RNA in protein synthesis.

Materials / Preparation Notes

-Protein Synthesis Project Directions/Rubric Handout03.1 Res Chloe Robitaille- Project Instructions

-student's science journals (small blue books)

-I-pads equipped with Educreations or ShowMe Application

-computers with ability to view animations:http://www.youtube.com/watch?v=5MfSYnItYvgandhttp://www.youtube.com/watch?v=8dsTvBaUMvw

-text,*Biology, the Living Science*by Levine and Miller

-large poster paper

-construction paper

-colored markers

-scissors

-Genetic Code Diagram, pg. 184 03.2 Res Chloe Robitaille- the Genetic Code

-Translation Diagram, pg. 185 03.3 Res Chloe Robitaille- Translation Diagram

-concept map, pg. 193 03.4 Res Chloe Robitaille- Concept Map

-write the journal question, "how do the 4 nucleotides A, U, G, C, formulate a genetic code for 20 different amino acids?" on the board

Instruction

Wait to distribute all materials, including project rubric, until project has been introduced.

Opening

Explain that over the next two class periods, we will tie everything together that we have learned about DNA, RNA and their role in creating the proteins that our bodies are made of. As a journal entry, have students reflect on the question on the board individually. Prompts such as "think of the 4 nucleotides as letters, how many words could you produce with just four letters?" may be required if students are having trouble with the journal question. After several students have shared their predictions, explain that the nucleotides are read in "codons" or groups of three, and that each amino acid coincides with one or several codons. While each amino acid may be represented by more than one codon, each individual codon only signifies ONE amino acid. To reinforce this idea, have students complete the following in their notebooks, using the genetic code diagram:

-find all of the codons that signify

1. methionine

2. leucine

3. stop

-find the amino acid coded by

4. UCC

5. GCA

6. ACU

After around 5 minutes, go over the answers as a class, taking the time to explain what a stop codon is at number 3.

Activities

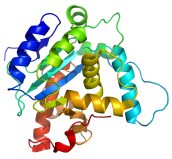
Have students put their journal booklets away. Explain that we will spend the rest of the class exploring how these 3 letter codons are able to create all of the proteins inside our bodies. Instead of explaining the process of translation to them, however, I would like them to do their own research and combine this with their knowledge of transcription to create either a poster, animation, or presentation, which explains how proteins are synthesized using the genetic code. At this point pass out the project directions and go over the directions with the class, emphasizing that the projects must begin with the process of transcription. Explain that students will have the remainder of this period (~25 minutes) and all of next period to create their projects. Suggest that students spend the whole rest of the class researching translation (steer them toward the diagram in their book and the

animations on the computers) and planning their projects, and that they shouldn't start the actual creation of their projects next class. They may want to continue their planning over the weekend or even meet as a team before next class so they are done planning and ready to create by the start of next class.
Pair students off and allow them to begin work, showing them where their materials are located in the classroom. As students work, clarify any misconceptions and monitor the collaboration between partners to make sure all students are participating.
If the construction of the project seems like it will take longer than 1.5 class periods to create, allow students 25 minutes of another class period to finish. After students have put the finishing touches on their projects, spend the last half of the third period in this lesson sharing projects with the class. To avoid repetition and save time, have partners who created posters or recorded animations share their favorite piece of the project, not the whole thing, with the class. Collect projects for grading.

Closing
As projects are being collected, ask students for input about how they feel their projects went, anything they still need clarified, and their major take-aways from the past week or so of class. Discuss how proteins make up a large percentage of the human body, but also act as enzymes that catalyze many reactions necessary to sustain life. Address any problems students may still be having with the material. For homework, assign students the concept map on pg. 193. Explain that this exercise is a great way to synthesize all that we have learned in the past several lessons. End the class by explaining that we will use all of our new knowledge of DNA and the genetic code to explore how our genes work.

Assessment Notes
Collect homework to assess if remedial instruction on any of the topics covered in lessons 1-3 is required. Grade projects based on holistic rubric on the project instructions handout. In-class project counts as 2 quiz grades.

03.1 Res Chloe Robitaille- Project Instructions



Protein Synthesis- In-Class Project Instructions

-work in pairs

-you have the rest of today and all of next class to complete the project

-after the project is completed, you will present the project to your peers

-as a pair, you may choose to create either an informational poster, an animation using the Educreations or ShowMe app on the I-pads, OR a dance/live simulation like we did as a class last period. DO NOT CHOOSE MORE THAN ONE! If you have an idea for a different project format, come see me and we may be able to work something out.

-this is an opportunity to use your creativity, or love of art or drama in science class, don't be shy!

-you may use as many resources as you like, including me, to find out as much as possible about the process of protein synthesis

-project will be counted as 2 quiz grades and will be graded based on the criteria listed below

A project that meets the standard will:

-use one of the approved formats

-include the processes of transcription and translation

-appropriately demonstrate the role of**DNA, RNA polymerase, mRNA, tRNA, ribosomes, codons**, and**Amino Acids**in protein synthesis

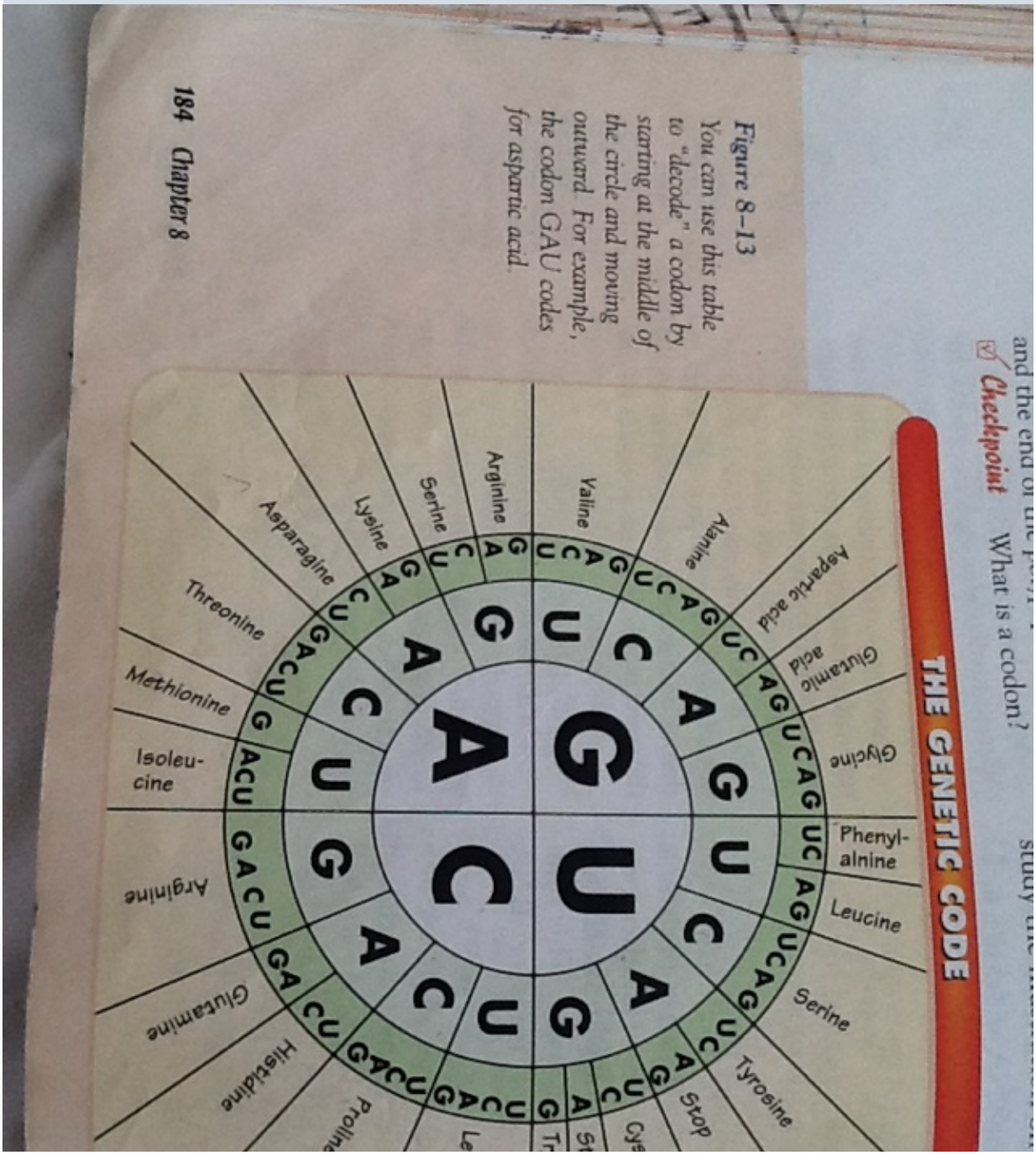
-have written (if creating a poster) or spoken (if creating an animation or demonstration) descriptions/explanations of the above bolded terms

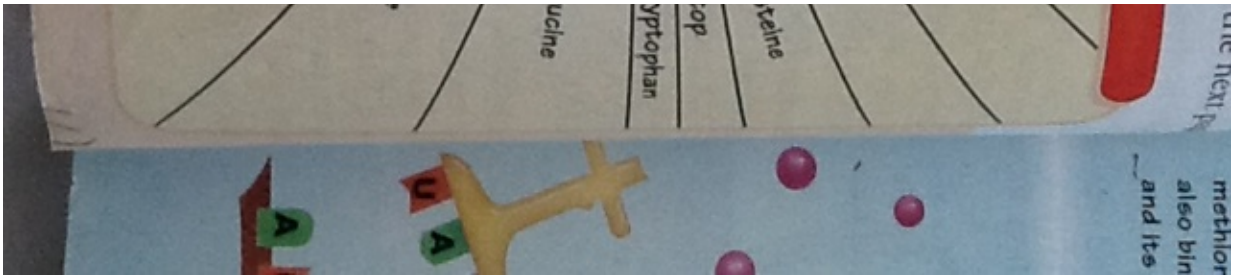
and their role

-show creativity

-be visually appealing

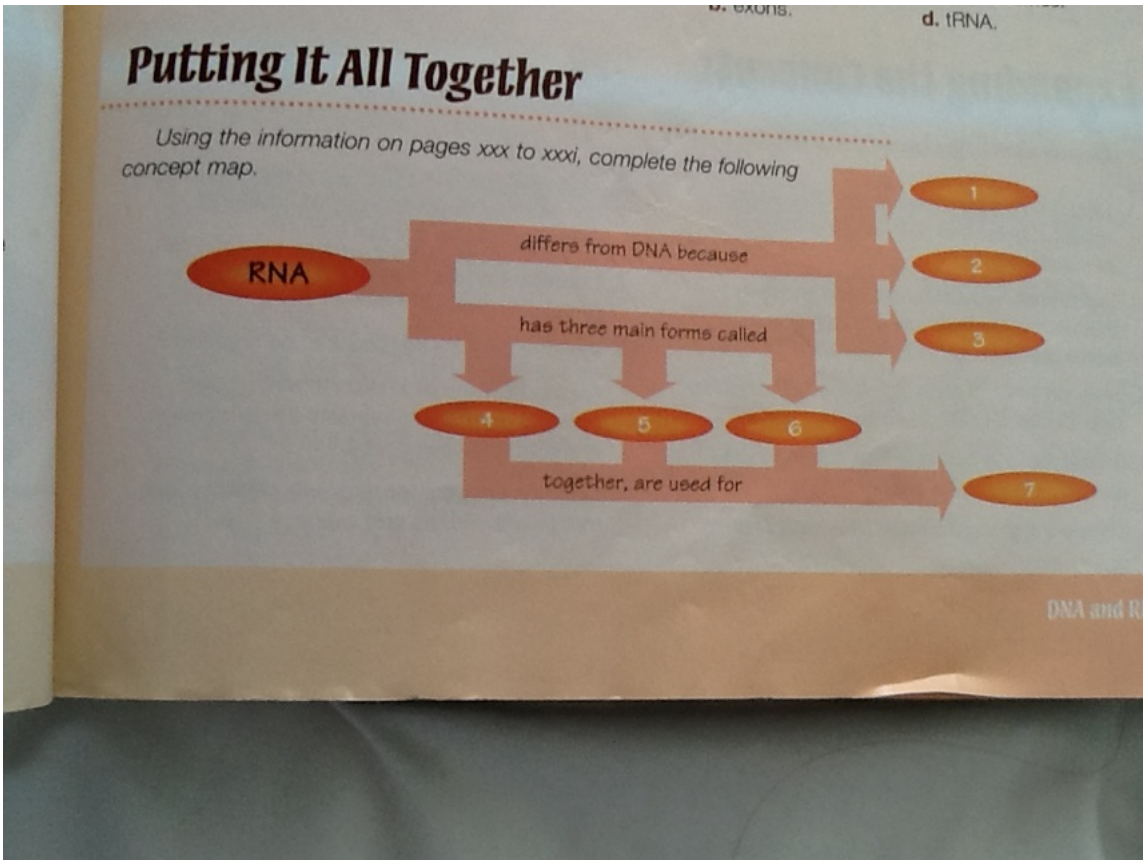
03.2 Res Chloe Robitaille- the Genetic Code





03.3 Res Chloe Robitaille- Translation Diagram

03.4 Res Chloe Robitaille- Concept Map



04.0 Brittany Barlow Mendel's Basics

Map

Overview Mendel's Basics

This is the third lesson in the unit, and the first in the subunit of Mendelian genetics. This lesson will focus on Mendel's law of dominance and introduce appropriate vocabulary. The class will start off with a poll of certain traits which the students will fill out on their own. Then a powerpoint lecture will be given with a supplemental note taking guide. The class will then end with the poll and go over important questions together on the poll worksheet.

Standards (Links)

Unit Standards

Objectives

Students will be able to identify the contributions Mendel made to our current understanding of genetics.
Students will be able to distinguish and define the differences between genes and alleles.
Students will be able to explain the difference between dominant and recessive alleles and how they relate to one another.

Materials / Preparation Notes

Lesson 4 Polling sheet
Lesson 4 Powerpoint
Note taking worksheet

Instruction

Opening
Class will start with the polling sheet. After passing out the worksheet I will go over what each trait looks like. I will give students about ten minutes to fill out the worksheets on their own and then draw the attention back to the front. We will together fill in the numbers for the whole class and the percentages which again will take about five to ten minutes.

Instruction
I will then pass out the note taking worksheets and start the powerpoint. The questions for the class are incorporated in the powerpoint:

Are genes the only factor that determine our genetics?
Why is there no heterogenous dominant or recessive alleles?
Which is true breeding?
Is a dominant allele better than a recessive trait?
Would a dominant allele be more likely to be inherited than a recessive allele?

Closing
After the powerpoint, which I anticipate to take around 30 minutes, we will switch back to the polling sheet. After learning about recessive and dominant traits I expect them to fill out the first two questions on the sheet. After they fill that out I will then tell them which traits are in fact dominant or recessive which will not match up to what the class data shows. The last question I'll have them fill out on their own. If we have time I will go over it at the end of class or at the beginning of next class.

Assessment Notes

Formative: Note outline, will collect "notebooks" after the subunit.
Continuing: Homework
Summative: Vocabulary quiz

04.0 Brittany Weekly Schedule

Map

Class:

Week:

Topic/Unit:

Date: Monday	Due Today:	Objectives:	Standards:	Hook: Engagement:	Acc & Mod:	Homework Assignment:

				Closure:		
Date:	Due Today:	Objectives:	Standards:	Hook: Engagement: Closure:	Acc & Mod:	Homework Assignment:
Date:	Due Today:	Objectives:	Standards:	Hook: Engagement: Closure:	Acc & Mod:	Homework Assignment:
Date:	Due Today:	Objectives:	Standards:	Hook: Engagement: Closure:	Acc & Mod:	Homework Assignment:
Date:	Due Today:	Objectives:	Standards:	Hook:	Acc & Mod:	Homework Assignment:

				Engagement: Closure:		

04.1 Brittany Barlow Mendel's Powerpoint

Author: Brittany Barlow

04.2 Brittany Barlow Polling Worksheet

Author: Brittany Barlow

04.3 Brittany Barlow Notetaking Worksheet

Author: Brittany Barlow

04.4 Inherited vs Non inherited HW

Author: Brittany Barlow

PDF Attachment

04.5 Brittany Barlow Lesson 4 Quiz

Author: Brittany Barlow

05.0 Brittany Barlow Genotype and Phenotype

Author: Brittany Barlow

Overview Mendel's Basics

This is the fifth lesson of the unit and the second lesson of the subunit. This lesson focuses on genotype and phenotype and which alleles an individual can pass on to it's offspring. Students will watch a YouTube video which focuses on the word phenotype. Students will then have to define the word using prior knowledge and inferences from the video. Students will then take notes from a powerpoint and then work on an activity which relates the genotype to phenotype. Students will then leave the class with homework and a quiz next class.

Standards (Links)

Unit Standards

Objectives

Students will be able to distinguish between genotype and phenotype.
Students will understand how the DNA code relates to phenotype.
Students will be able to show which gametes a individual with a certain phenotype can pass on.

Materials / Preparation Notes

Phenotype youtube clip
Lesson 5 Powerpoint
Lesson 5 Note Taking guide
Lesson 5 Worksheet
Lesson 5 HW
Create your own dog Activity (I can't get Evernote to upload the pictures I took of the activity.)

Instruction

Opening
Class will start with students in groups and I will play the youtube clip. Students will then work in groups and try to define the work phenotype. They will have poster board and write their definition down and present to the class.

Instruction
After sharing their definitions students will then take notes using the note taking guide with the powerpoint. The powerpoint will go over phenotype, genotype, alleles, and what gametes each parent can pass on. Students will then complete a worksheet as a class describing the alleles that each parent can pass on.
Students will then work in partners and complete the create your own dog activity. Students will create a dog using a set of given traits such as long hair, short ears, small dog, large body. After writing the code for their dog they will draw their dog. Students will then give the genetic code to their partner who must read the code and draw what the code displays. Hopefully both drawings will look the same.

Closing
After the activity students can choose to share their dog with the class. Homework will be distributed and a quiz will occur next class.

Assessment Notes

Formative: Create your own dog activity
Continuing: Homework
Summative: Quiz next class

05.1 Brittany Barlow Genotype Powerpoint

Author: Brittany Barlow

05.2 Brittany Barlow Genotype Note Taking Guide

Author: Brittany Barlow

05.3 Brittany Barlow Genetics Homework

Author: Brittany Barlow

05.4 Brittany Barlow Lesson 5 Worksheet

Author: Brittany Barlow

05.5 Brittany Barlow Quiz

Author: Brittany Barlow

For some reason you can't open this unless downloaded. I even saved it as a doc instead of a docx and I can't figure out what is wrong. Sorry!

06.0 Brittany Barlow Punnet Squares

Author: Brittany Barlow

Overview Mendel's Basics

Standards (Links)

Unit Standards

Objectives

Materials / Preparation Notes

Powerpoint
Note Taking Guide
Dragon Genetics
Worksheet
Spongebob Genetics

Instruction

Opening

Activity

Closing

Assessment Notes

Formative: Worksheet
Continuing: Homework
Summative: Unit Test

06.1 Brittany Barlow Powerpoint

Author: Brittany Barlow

06.2 Brittany Barlow Worksheet

Author: Brittany Barlow

06.5 Brittany Barlow PPT 3 Note Taking

Author: Brittany Barlow

07 LP Sam Barrus-Neither Dominant nor Recessive:

Alternate Forms of Dominance

Overview: This will be the seventh lesson in the Genetics Unit Plan; for my particular subunit, it is the first of three lessons. It will be followed by lessons on genetic diversity derived from meiotic events or multiple gene interactions or linkage and chromosome mapping. After learning Mendelian genetics, punnett squares, monohybrid and dihybrid crosses and their associated ratios, they will be able to extend this knowledge to non-Mendelian forms of inheritance. The content will focus on alternate forms of dominance and will include a lab that involves figuring outthe type of inheritance that is occurring by looking at a sample population of "bears."

Standards (Links)
07/08 Sam Barrus Content Standard-7b

Objectives
Students will be able to...
1. explain the differences between non-Mendelian forms of inheritance
2. distinguish different inheritance patterns through the interpretation of raw data
3. defend their results through representations (graphs, charts, written explanations) of acquired data and statistical analysis

Materials / Preparation Notes

Plans to differentiate instruction:
Below Grade Level:provide completed notes sheet
Above Grade Level:additional aspects to the lab; more in depth answers are expected, as well as more advanced data interpretation and statistics (07.5 Res Sam Barrus-Chi Square Information (Honors))

Accommodations and Modifications:
ADHD: arrange quieter separate space for student and partner to complete the lab, choose partner deliberately to be a role model and motivate the student.

Specific Learning Disability (Reading): “read-along” style of lecture and note taking, vocabulary breakdown worksheets available, ability to interact in discussions,can use reading software on computer if available to read lab information

Physical Disability (mild hearing loss): able to listen to lecture on personal computer with headphones, display final class data on board.

Environment factors:
Grade:11th Grade CP
Students:22 kids: 12 boys, 10 girls
Grouping:heterogeneous
Room set up: initially standard set up of desks in rows, for activity shift to two desk groupings, then back to the original for closing discussion.

Timing: (10 minute opener)(20 minutes lecture) (50 mins pair work) (10 min closing to check for understanding/ask questions/go over problems)

Materials:
- Gummy bear groups in plastic bags
- Handouts:
  -Note taking sheet
  -Gummy Bear Lab Packet
  -07/08/09.0 Sam Barrus Res- Word Family Tree Sheet

Instruction
Opening: Class will begin withIntroductory Photoson the board: a chicken and a flower. I’ll ask if anyone knows what these things have in common and wait for responses from a few students. I’ll then show the second set of pictures--the parents of each of the items. How can inherited alleles result in something that doesn’t look like either of the phenotypes of the parents? Following whatever they answer, I will tell them that all these things have a trait that was inherited through genes that were not necessarily dominant or recessive.

Activities: Following a brief engagement and exploratory session, some material will be presented with a short lecture from Youtube:http://www.youtube.com/watch?v=fQvER3MyI2c(up to approx. 4:30) on the topics of codominance and incomplete dominance.

While watching the video, students will fill out a provided note taking worksheet to fill in as they watch; after I will go over the sheet with the class, correct any misconceptions, and allow them to ask questions.Lesson One Note Outline.pdf

The main activity of the day is the Gummy Bear Lab; students will work in pairs as a team of field researchers filling out a field notebook on an observed population of (gummy) bears.Gummy Bear Lab Developed

Closing: With about 10-15 minutes left in class, I will bring the class back into a whole group. Ideally, we will go over each group's results and students will be able to add additional data to their individual lab packets. Depending on how far students progressed in the packet, we will turn back to the Venn diagram in the notes page and compare the two forms of dominance for review and clarification; if they worked efficiently, perhaps we can discuss some working answers to the critical thinking questions and how to continue answering them individually at home.I will tell them next time we'll be coloring and ask them to bring colored pencils/crayons/markers for tomorrow but not tell why, hopefully to garner some excitement for the next lesson.

Assessment Notes
Formative:in class note outline, in class participation in discussion and lab activities.
Continuing:completion of lab packet for homework
Summative:completed lab packet; typed questions; charts, graphs, figures

07.1 Res Sam Barrus-Introductory Photos


Primary photo set: A chicken displaying codominant plumage and snapdragons displaying incomplete dominance. These will be the initial photos displayed on the board at the beginning of lesson one.

Secondary photo set: This set represents the parents of the two organisms from the previous photo set. Up until now, students have only been exposed to complete dominance and recessiveness of traits. The two sets together will hopefully lead students to question how the chicken and the flower can display phenotypes that are unlike both of the parents. Realistically, they will be able to derive an answer that the offspring of the parents are displaying parts of both of the parents' phenotypes, which will segue into the content of the lesson.

07.2 Res Sam Barrus Lesson-One Note Outline

PDF Attachment

07.3 Res Sam Barrus-Gummy Bear Lab

PDF Attachment

07.4 Res Sam Barrus-Baby Bears Everywhere

Developed from thisOriginal Lab, revised questions, new ways to display inheritance patterns created.

PDF Attachment

07.5 Res Sam Barrus-Chi Square Information

(Honors)

Source URL: http://www2.lv.psu.edu/jxm57/irp/chisquar.html

CHI-SQUARE TEST

Chi-Square Test

Chi-square is a statistical test commonly used to compare observed data with data wewould expect to obtain according to a specific hypothesis. For example, if, according toMendel's laws, you expected 10 of 20 offspring from a cross to be male and the actualobserved number was 8 males, then you might want to know about the "goodness tofit" between the observed and expected. Were the deviations (differences betweenobserved and expected) the result of chance, or were they due to other factors. How muchdeviation can occur before you, the investigator, must conclude that something other thanchance is at work, causing the observed to differ from the expected. The chi-square testis always testing what scientists call the **null hypothesis,** which states that thereis no significant difference between the expected and observed result.

The formula for calculating chi-square ( )is:

= *(o-e)/e*

That is, chi-square is the sum of the squared difference between observed (*o*)and the expected (*e*) data (or the deviation, *d*), divided by the expecteddata in all possible categories.

For example, suppose that a cross between two pea plants yields a population of 880plants, 639 with green seeds and 241 with yellow seeds. You are asked to propose thegenotypes of the parents. Your *hypothesis* is that the allele for green is dominantto the allele for yellow and that the parent plants were both heterozygous for this trait.If your hypothesis is true, then the predicted ratio of offspring from this cross would be3:1 (based on Mendel's laws) as predicted from the results of the Punnett square (FigureB. 1).

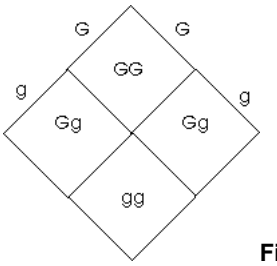


Figure B.1 -Punnett Square. Predicted offspring from cross between green and yellow-seeded plants.Green (G) is dominant (3/4 green; 1/4 yellow).

To calculate , first determinethe number *expected* in each category. If the ratio is 3:1 and the total number ofobserved individuals is 880, then the *expected numerical values* should be 660 greenand 220 yellow.

Chi-square requires that you use numerical values, not percentages orratios.

Then calculate using this formula,as shown in Table B.1. Note that we get a value of 2.668 for . But what does this number mean? Here's how to interpret the value:

1. Determine degrees of freedom (df). Degrees of freedom can be calculated as thenumber of categories in the problem minus 1. In our example, there are two categories(green and yellow); therefore, there is I degree of freedom.

2. Determine a relative standard to serve as the basis for accepting or rejecting thehypothesis. The relative

standard commonly used in biological research is $p > 0.05$.The p value is the *probability* that the deviation of the observed from thatexpected is due to chance alone (no other forces acting). In this case, using $p>0.05$, you would expect any deviation to be due to chance alone 5% of the time or less.

3. Refer to a chi-square distribution table (Table B.2). Using the appropriate degreesof 'freedom, locate the value closest to your calculated chi-square in the table.Determine the closest*p* (probability) value associated with your chi-square anddegrees of freedom. In this case (=2.668),the p value is about 0.10, which means that there is a 10% probability that any deviationfrom expected results is due to chance only. Based on our standard $p > 0.05$,this is within the range of acceptable deviation. In terms of your hypothesis for thisexample, the observed chi-squareis not significantly different from expected. The observednumbers are consistent with those expected under Mendel's law.

Step-by-Step Procedure for Testing Your Hypothesis and Calculating Chi-Square

1. State the hypothesis being tested and the predicted results. Gather the data byconducting the proper experiment (or, if working genetics problems, use the data providedin the problem).

2. Determine the expected numbers for each observational class. Remember to usenumbers, not percentages.

Chi-square should not be calculated if the expected value in anycategory is less than 5.

---

3. Calculate using the formula.Complete all calculations to three significant digits. Round off your answer to twosignificant digits.

4. Use the chi-square distribution table to determine significance of the value.

1. Determine degrees of freedom and locate the value in the appropriate column.
2. Locate the value closest to your calculated on that degrees of freedom *df* row.
3. Move up the column to determine the p value.

5. State your conclusion in terms of your hypothesis.

1. If the *p* value for the calculated is $p > 0.05$, accept your hypothesis. 'The deviation is small enough that chance alone accounts for it. A *p* value of 0.6, for example, means that there is a 60% probability that any deviation from expected is due to chance only. This is within the range of acceptable deviation.
2. If the p value for the calculated is $p < 0.05$, reject your hypothesis, and conclude that some factor other than chance is operating for the deviation to be so great. For example, a p value of 0.01 means that there is only a 1% chance that this deviation is due to chance alone. Therefore, other factors must be involved.

The chi-square test will be used to test for the "goodness to fit" betweenobserved and expected data from several laboratory investigations in this lab manual.

Table B.1
Calculating Chi-Square

	Green	**Yellow**
Observed (o)	639	241
Expected (e)	660	220
Deviation (o - *e)*	-21	21
Deviation (d2)	441	441
d/e	0.668	2
= d/e = 2.668	.	.

Table B.2
Chi-Square Distribution

Degrees of Freedom (*df*)	**Probability** (*p*)									
	0.95	0.90	0.80	0.70	0.50	0.30	0.20	0.10	0.05	0.01	0.001
	0.004	0.02	0.06	0.15	0.46	1.07	1.64	2.71	3.84	6.64	10.83
	0.10	0.21	0.45	0.71	1.39	2.41	3.22	4.60	5.99	9.21	13.82
	0.35	0.58	1.01	1.42	2.37	3.66	4.64	6.25	7.82	11.34	16.27
	0.71	1.06	1.65	2.20	3.36	4.88	5.99	7.78	9.49	13.28	18.47
	1.14	1.61	2.34	3.00	4.35	6.06	7.29	9.24	11.07	15.09	20.52
	1.63	2.20	3.07	3.83	5.35	7.23	8.56	10.64	12.59	16.81	22.46
	2.17	2.83	3.82	4.67	6.35	8.38	9.80	12.02	14.07	18.48	24.32
	2.73	3.49	4.59	5.53	7.34	9.52	11.03	13.36	15.51	20.09	26.12
	3.32	4.17	5.38	6.39	8.34	10.66	12.24	14.68	16.92	21.67	27.88
	3.94	4.86	6.18	7.27	9.34	11.78	13.44	15.99	18.31	23.21	29.59
	Nonsignificant							Significant			

Source: R.A. Fisher and F. Yates, Statistical Tables for Biological Agricultural andMedical Research, 6th ed., Table IV, Oliver & Boyd, Ltd., Edinburgh, by permission ofthe authors and publishers.

07/08 Sam Barrus Content Standard-7b

Students demonstrate an understanding of
Natural Selection/ evolution by…

7a investigating how information is passed from parents to offspring by encoded molecules (e.g. evidence from electrophoresis, DNA fingerprinting).

7b investigating how the sorting and recombination of genes in sexual reproduction results in a great variety of possible gene combinations in the offspring of any two parents. (e.g. manipulate models to represent and predict genotypes and phenotypes, Punnett Squares, probability activities).

7c citing evidence of how natural selection and its evolutionary consequences provide a scientific explanation for the diversity and unity of past and present life forms on Earth.(e.g. Galapagos Islands, Hawaiian Islands, Australia, geographic isolation, adaptive radiation).

LS - 7a/7b

What do these GSEs mean? What subtopics do students need to address to understand these GSEs?

- Probability and Ratios- Students need to understand that probability is the chance of an event happening. In relation to genetics, the types of traits an offspring will possess depend on probability. A ratio is a comparison of two different occurences (i.e. 3/4 brown eyes: 1/4 blue eyes).
- Traits- characteristics of an individual such as hair and eye color, height, or skin color.
- Independent Assortment- The theory that alleles separate from each other during sexual reproduction to give an equal probability of offspring receiving a trait.
- Monohybrid cross- cross between one trait from two different organisms

- Dihybrid cross- cross between two traits from two different organisms
- Punnet Squares- diagram used to predict the outcomes of a particular monohybrid, dihybrid, etc. genetic cross. A punnett square assumes independent assortment of the alleles or a particular trait.
- Genotype vs. Phenotype- A genotype is the genetic makeup of an individual (i.e. Bb), while the phenotype is the actual trait characteristic (i.e. blue eyes)
- Parent - Offspring Relationships
- Trait Inheritance
- Natural Selection and Evolution- Natural selection is the process by which traits become more or less common in a population depending on how the traits contribute to the survival of the organism. Evolution is the change of traits in a population over time.

What ideas to students need to understand before they can address the topics described above?

- Students need to have a basic understanding of the following topics:
    - DNA and structure
    - Parent-offspring relationships
    - Sexual reproduction through meiosis

What misconceptions are students likely to have about these topics?

- The following topics may cause student misconceptions:
    - Punnet squares and how to complete them
    - The difference between monohybrid and dihybrid.
    - The difference between phenotype vs. genotype.
    - Nature vs. Nurture in Natural Selection

What phenomena and representations help students understand these topics?

- Mendel's Pea plant experiments- show the use of Punnett Squares and display how probability comes into play when crossing traits.
- Modeling punnet squares
- How the genotype is expressed in the phenotype.
- Modeling evolution through natural selection using the Galapagos Islands as an evolutionary example.

Other resources related to this GSE:

Delicious/fogleman/RI-GSE-LS3%289-11%29-7_DNA_Genetics

- Can You Roll Your Tongue? Pedigree Practice | Extreme Biology Blog Dec 14, 2010
- AAAS Podcast: Neandertal Genome May 24, 2010
  AAAS Podcast on Neandertal Genome: You've probably heard that scientists have now sequenced the genome of our extinct Neandertal relatives. Svante Pääbo is director of the Max Planck Institute of Evolutionary Anthropology in Germany. His team com...
- CanvasMol May 14, 2010
  Molecule visualization tool. Several sample molecules are included no the site for 3D visualization.
- Essentials of Genetics | Learn Science at Scitable Feb 6, 2010
  Extensive collection of learning materials dealing with several aspects of genetics.
- American Museum of Natural History Jan 4, 2010
  Science blogger's account of the evidence for a new species of cockroach discovered in New York City by students at Trinity school.
- Cotton: Building a Better Plant : Living the Scientific Life (Scientist, Interrupted) Jan 4, 2010
  This is another beautifully written and produced video about plant research. The lucky plant? This time, it's cotton -- what jeans and t-shirts are made of! This video explores how modern cotton plants came to be, the 50 species of cotton, and how...
- Regulatin' Genes | SciVee Dec 30, 2009
  This parody of Jay-Z's "Money Ain't a Thang" explores the wonderful world of developmental biology. Made for Human Biology 3A at Stanford University. Lyrics (shown below) by Tom McFadden, performance by Tom and Derrick Davis, cameo by Bob Siegel, ...
- New York High Schoolers May Have Discovered New Cockroach Species Dec 29, 2009
  "Using DNA tests, two seniors at Manhattan's Trinity School found plenty of food that wasn't what the labels said it was. A test of DNA from a cockroach found in an apartment on the Upper West Side suggests it may represent a new species or subspe...
- Is nicotinamide overload a trigger for type 2 diabetes? Dec 24, 2009
  "Type 2 diabetes is a major global health problem. Although the underlying mechanism of the pathogenesis is not clear, generally it is accepted that type 2 diabetes is a result of gene-environment interactions. A research group from China investig...
- Two genes discovered that drive aggressive brain cancers Dec 24, 2009
  "Scientists have discovered two genes that, when simultaneously activated, are responsible for the most aggressive forms of brain cancer. This finding was made possible by the assembly of the first comprehensive network of molecular interactions t...
- Genomes of identical twins reveal epigenetic changes that may play role in lupus Dec 23, 2009
  "Identical twins look the same and are nearly genetically identical, but environmental factors and the resulting cellular changes could cause disease in one sibling and not the other. Scientists have studied twins discordant for the autoimmune dis...
- Discovery of new gene called Brd2 that regulates obesity and diabetes Dec 23, 2009

"The chance discovery of a genetic mutation that makes mice enormously fat but protects them from diabetes has given researchers new insights into the cellular mechanisms that link obesity to type 2 diabetes."

- Gene for devastating kidney disease discovered Dec 23, 2009
  "A genetic discovery offers new hope for a better treatment for a mysterious, devastating kidney disease that's the second leading cause of kidney failure in children. The disease forces children and young adults onto dialysis and, all too often, ...
- Gene therapy makes mice breath easier: Preventing progression of emphysema Dec 22, 2009
  "Researchers have discovered a new gene therapy that may prevent the progression of emphysema. The study describes a method to express therapeutic genes in lung tissue for a lifetime after only a single treatment."
- Top 100 Stories of 2009: #81: Inserting Human Gene Into Mouse Brains Gives Them Lower Voices Dec 22, 2009
  "Researchers don't know exactly what FOXP2 does in humans, but it's the gene most directly linked to speech that we know of."

07/08/09.0 Sam Barrus Res- Word Family Tree Sheet

Author: educationcopier@uri.edu

PDF Attachment

08 LP Sam Barrus-Gene Interaction and Linkage

Overview: This is the second lesson in a series of three in the Beyond Mendel subunit of the genetics unit plan. Students have just learned about alternate forms of dominance (codominance, incomplete dominance) and completed a lab assignment where the goal was to identify inheritance patterns of a population by observing phenotypes and corroborate their answers using data like punnet squares, chi-square analysis, ratios etc. This lesson will focus on other origins of genotypic/phenotypic variation. The next lesson will finalize the subunit with an introduction to epigenetics

Standards (Links) Objectives:
07/08 Sam Barrus Content Standard-7b

Students will be able to:
1. differentiate between terminology concerning genotypic/phenotypic variation
2. design a poster that provides sufficient information to explain a vocabulary term
3. compare different forms of genetic variation in terms of involved genes and associated phenotypic effects

Materials / Preparation Notes:
Plans to differentiate instruction:
Below Grade Level:n/a
Above Grade Level: Honors extension: summarize and reflect on08.2 Sam Barrus Res Honors Extension(~1.5-2 page reflection to be handed in next class with other work)

Accommodations and Modifications:
ADHD:front of room seating for reading activity and note taking, to resource center to work on project if desired (will be a computer and a special education teacher to supervise research)

Specific Learning Disability (Reading):review article (provide copy) with whole class and on-board mark ups, vocabulary breakdown worksheets integral to summative assessment, presentation graded separately, work with partner for poster project (optional)

Physical Disability (mild hearing loss):review of article (provide copy) with whole class and on-board mark ups, work with partner for poster project (optional)

Environment factors:
Grade:11th Grade CP
Students:22 kids: 12 boys, 10 girls
Grouping:heterogeneous
Room set up: Individual desks in rows to enter class and answer science warm-up ticket, lecture etc. Students may go to the library during independent work or use personal technology in class; it is fine for them to choose to work in small groups while researching if they are quietly sharing ideas and materials. If the atmosphere becomes too chaotic, the original set-up will be put into effect.

Timing: 2 class periods @ 90 mins(15 mins opener: 5 for ideas, 10 for discussion) (30 mins lecture) (45 mins research)+++++++++(70 mins posters and discussion w/ notes) (20 mins next period prep)

Materials:
Computers
Projector
IPad
Reference Materials (biology textbooks, internet module, other electronic sources...)
Paper/Markers/Pencils etc.

Instruction
Opening/Hook:

1. **Opening Prompt:***How does your new knowledge of the spectrum of dominance complicates Mendel's Law of Segregation? Which of his hypotheses were shown to be false and what are the implications in terms of genetic variation?*I think students will be interested because they were just taught how important Mendel's work was to the field of genetics, and now I can tell them that in some ways, his laws didn't apply and much weirder things are capable of happening.
2. **Activity:**I will introduce some background on Thomas Hunt Morgan and his flies by going over a short internet module with the students and the iPad, while discussing how his research disproved Mendel's independent assortment law and introduce new vocabulary. 08.1 Sam Barrus Res Genetics Module 3.4, Gene Linkage

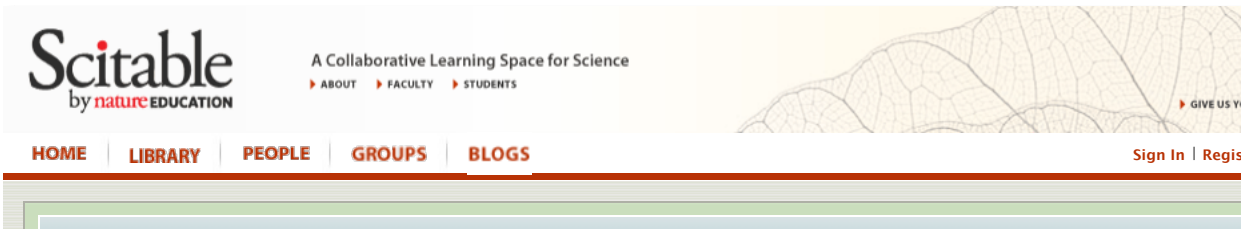
2. **Activity:**Students will be given a list of relevant terms or concepts for the entire unit (08.3 Sam Barrus Res-Subunit Vocabulary List) and sign up to discuss on one of their choosing either the next class period or the following lesson. Students will make a poster with enough information to help their classmates better understand the mechanisms of genetic diversity. We will then have a full class discussion where students share important parts of their poster, answer questions from their peers, with me facilitating and guiding the content. Their participation in the discussion and resulting poster will be graded according to a rubric.08.4 Sam Barrus Res Discussion RubricWhile they are talking I will write relevant points on the iPad and show it through the projector; I can choose to use a note-taking application or one that creates maps like iBrainstorm or MindjetMaps. All posters will be shrunk to be integrated into a working genetics study guide for the culmination of the unit and our resulting discussion can be printed to be integrated as well.

Closing: As the first class period closes I will ask students to finish their poster and have discussion points for the next period. At the end of the discussion on the second day, I will give students the empty bingo card to fill in for the next lesson.09.1 Sam Barrus Res-Genetics Bingo CardThe next lesson we will play genetics bingo and introduce the concept of epigenetics.

Assessment Notes:
Formative: In-class participation during internet module, opening science prompt
Continuing: Vocabulary sheets (at least***five***to be in final unit portfolio) and finishing their project for the next class period, fill in bingo card
Summative: Poster & presentation, reflection (honors extension)

08.1 Sam Barrus Res Genetics Module 3.4, Gene Linkage

Source URL: http://www.nature.com/scitable/ebooks/essentials-of-genetics-8/112#bookContentViewAreaDivID



3.4Some Genes Are Transmitted to Offspring in Groups via the Phenomenon of Gene Linkage

PREV PAGE NEXT PAGE

Although Mendel's principle of independent assortment states that alleles of different genes will segregate independently into gametes, in reality, this is not always the case. Sometimes, alleles of certain genes are inherited together, and they do not appear to undergo independent assortment at all.

Black fly with short wings

Indeed, shortly after Mendel's discoveries about inheritance patterns became widely known, numerous researchers began to notice exceptions to his principles. For example, they realized that some crosses contradicted Mendel's principle of independent assortment, because these crosses produced organisms with certain phenotypes far more frequently than traditional Mendelian genetics predicted.

Based on these findings, these scientists hypothesized that certain alleles of one gene were somehow coupled with certain alleles of another gene; however, they were not sure how this could occur. This phenomenon is now known as **genetic linkage**, and it generally describes an inheritance pattern in which two genes located in close proximity to each other on the same chromosome have a biased association between their alleles. This, in turn, causes these alleles to be inherited together instead of assorting independently. Genetic linkage is a violation of the Mendelian principle of independent assortment.

Independent assortment in test crosses

To understand linkage, we must first compare it to an example of independent assortment of parental gametes. The best way to generate such an example is through a dihybrid test cross, which considers two different genes during a cross between two heterozygote parents. Mendel's principle of independent assortment predicts that the alleles of the two genes will be independently distributed into gametes.

Thus, according to Mendel's principles, a dihybrid cross between two heterozygous fruit flies with brown bodies and red eyes (BbEe X BbEe) should yield offspring with nine possible genotypes (BBEE, BBEe, BBee, BbEE, BbEe, Bbee, bbEE, bbEe, and bbee) and four possible phenotypes (brown body with red eyes, brown body with brown eyes, black body with red eyes, and black body with brown eyes) (Figure 1, left). In this case, the ratio of phenotypes observed among the offspring is 9 (brown body, red eyes): 3 (brown body, brown eyes): 3 (black body, red eyes): 1 (black body, brown eyes) (Figure 1, right). This 9:3:3:1 phenotypic ratio is the classic Mendelian ratio for a dihybrid cross in which the alleles of two different genes assort independently into gametes.

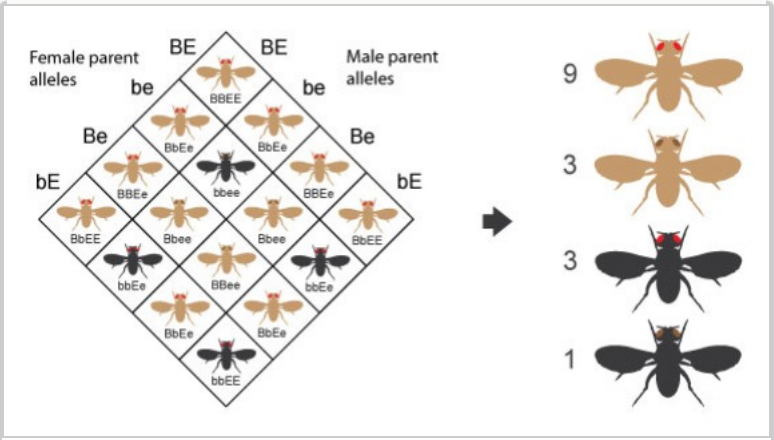


Figure 1:A classic Mendelian example of independent assortment: the 9:3:3:1 phenotypic ratio associated with a dihybrid cross (BbEe × BbEe).

In another example of Mendel's independent assortment principle, a test cross between a heterozygous BbEe fly and a homozygous bbee fly will yield offspring with only four possible genotypes (BbEe, Bbee, bbEe, and bbee) and four possible phenotypes (brown body with red eyes, brown body with brown eyes, black body with red eyes, and black body with brown eyes), as shown in Figure 2. Thus, in this case, the ratio of phenotypes observed among the offspring will be 1 (brown body, red eyes): 1 (brown body, brown eyes): 1 (black body, red eyes): 1 (black body, brown eyes).

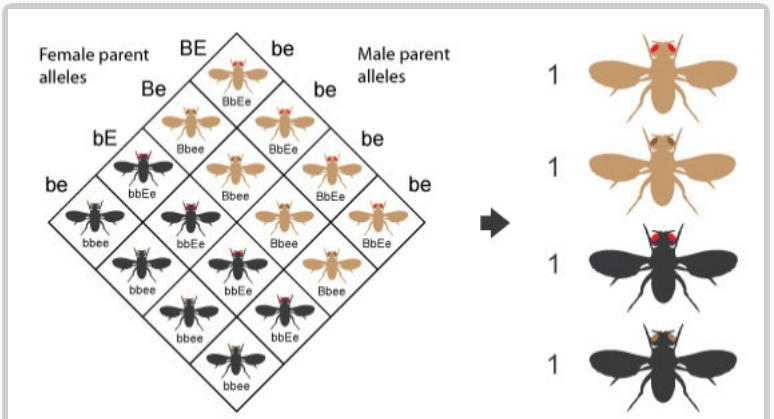


Figure 2:This 1:1:1:1 phenotypic ratio is the classic Mendelian ratio for a test cross in which the alleles of the two genes assort independently into gametes (BbEe × bbee).

Exceptions to independent assortment

In nature, some fruit fly traits like those described above assort independently, whereas others do not. As an example, consider the relationship between fruit fly body color and wing length. Here, the gene for wing length is represented by two alleles, V and v; the V allele codes for long wings, which is the dominant phenotype, and the v allele codes for short, misshapen wings (called **vestigial wings**), which is the recessive phenotype (Figure 3).

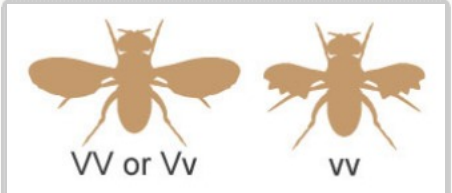


Figure 3:In fruit flies, the dominant V allele produces long wings, whereas the recessive v allele produces

vestigial wings. Thus, flies with the genotype VV or Vv will have long wings, and flies with the genotype vv will have vestigial wings.

In order to observe the inheritance pattern associated with fruit fly body color and wing length, a test cross between a BbVv fly and a bbvv fly can be performed. The results of this cross, however, will not follow the classic 1:1:1:1 phenotypic ratio expected with independent assortment. Instead, the offspring of this particular cross will be present in a 5:1:1:5 ratio (5 brown body with long wings: 1 brown body with vestigial wings: 1 black body with long wings: 5 black body with vestigial wings). These results indicate that there is a bias toward brown body color and normal wings being inherited together (BV), as well as toward black body color and vestigial wings being inherited together (bv), from the parent with the BbVv genotype (Figure 4). Note that the parent with the bbvv genotype can only contribute bv alleles.

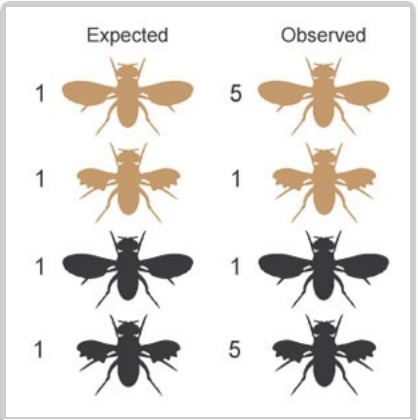


Figure 4:On the left is the expected phenotypic ratio of the offspring from a BbVv × bbvv cross (1:1:1:1). However, because the alleles BV and bv are linked, the observed phenotypic ratio is much different (5:1:1:5) than the expected ratio.

What is the reason for this 5:1:1:5 non-Mendelian phenotypic ratio? It turns out that the body color and wing length genes are linked, which means they are located very close to each other on the same chromosome. The consequence of this is that these gene alleles are much less likely to segregate independently into gametes. In addition, if two genes are linked in this way, then gametes are more likely to contain specific allele combinations. In this example, those combinations of alleles are BV and bv. As such, the heterozygous parent produces more BV and bv gametes than Bv and bV gametes. (Recall that the *homozygous* parent can only produce bv gametes.) This is why, when the BbVv fly is crossed with the bbvv fly, the resulting offspring are more likely to have BbVv and bbvv genotypes than Bbvv and bbVv genotypes, and the observed phenotypic ratio is 5:1:1:5. In fact, because the alleles do not assort independently into gametes during meiosis, Punnett squares like the ones shown in Figures 2 and 3 cannot be used to accurately predict inheritance patterns for crosses involving linked genes.

To return to the fruit fly example, linkage means that the BbVv parent is more likely to produce gametes that match those contributed by its own parents: BV and bv. Therefore, offspring with parental genotypes (BbVv and bbvv) are more common than offspring with non-parental, or recombinant, genotypes (Bbvv and bbVv) after the test cross. This means the parental genotypes and their corresponding phenotypes are observed five times more often than the recombinant genotypes and their corresponding phenotypes.

Summary

What is the lesson to be learned from the body color-wing length example? In short, whenever two genes are linked because of their location on a chromosome, their alleles will not segregate independently during gamete formation. As a result, test crosses involving alleles of linked genes will yield phenotypic ratios that stray from the classic Mendelian ratios. Also in the case of linked genes, the phenotypic ratio will show higher numbers of offspring with the parental genotypes than offspring with the recombinant genotypes.

Make your own fly

Breeding flies is an exciting way to learn genetics. There are many possible allele combinations within a fruit fly, and you can explore them via the interactive image below. Just click on a genotype button from each category below to make your own customized fly (*Drosophila melanogaster*).

Thomas Hunt Morgan

- The fly geneticist and his remarkable findings

08.2 Sam Barrus Res Honors Extension

Source URL: http://www.genomenewsnetwork.org/resources/timeline/1910_Morgan.php

Genetics and Genomics Timeline

1910

Thomas Hunt Morgan (1866-1945) establishes the chromosomal theory of heredity

Thomas Hunt Morgan, an embryologist who had turned to research in heredity, in 1907 began to extensively breed the common fruit fly, *Drosophila melanogaster*. He hoped to discover large-scale mutations that would represent the emergence of new species. As it turned out, Morgan confirmed Mendelian laws of inheritance and the hypothesis that genes are located on chromosomes. He thereby inaugurated classical experimental genetics.

After breeding millions of *Drosophila* in his laboratory at Columbia University, in 1910 Morgan noticed one fruit fly with a distinctive characteristic: white eyes instead of red. He isolated this specimen and mated it to an ordinary red-eyed fly. Although the first generation of 1,237 offspring was all red-eyed but for three, white-eyed flies appeared in larger numbers in the second generation. Surprisingly, all white-eyed flies were male.

Thomas Hunt Morgan

These results were suggestive for hypotheses of which Morgan himself was skeptical. He was at the time critical of the Mendelian theory of inheritance, mistrusted aspects of chromosomal theory, and did not believe that Darwin's concept of natural selection could account for the emergence of new species. But Morgan's discoveries with white- and red-eyed flies led him to reconsider each of these hypotheses.

In particular, Morgan began to entertain the possibility that association of eye color and sex in fruit flies had a physical and mechanistic basis in the chromosomes. The shape of one of *Drosophila's* four chromosome pairs was thought to be distinctive for sex determination. Males invariably possess the XY chromosome pair (Morgan used a more cumbersome notation) while flies with the XX chromosome are female. If the factor for eye color was located exclusively on the X chromosome, Morgan realized, Mendelian rules for inheritance of dominant and recessive traits could apply.

In brief, Morgan had discovered that eye color in *Drosophila* expressed a sex-linked trait. All first-generation offspring of a mutant white-eyed male and a normal red-eyed female would have red eyes because every chromosome pair would contain at least one copy of the X chromosome with the dominant trait. But half the females from this union would now possess a copy of the white-eyed male's recessive X chromosome. This chromosome would be transmitted, on average, to one-half of second-generation offspring—one-half of which would be male. Thus, second-generation offspring would include one-quarter with white eyes—and all of these would be male.

Intensive work led Morgan to discover more mutant traits—some two dozen between 1911 and 1914. With evidence drawn from cytology he was able to refine Mendelian laws and combine them with the theory—first suggested by Theodor Boveri and Walter Sutton—that the chromosomes carry hereditary information. In 1915, Morgan and his colleagues published The *Mechanism of Mendelian Heredity*. Its major tenets:

• Discrete pairs of factors located on chromosomes like beads on a string bear hereditary information. These factors—Morgan would soon call them genes—segregate in germ cells and combine during reproduction, essentially as predicted by Mendelian laws. However:

• Certain characteristics are sex-linked—that is, occur together because they arise on the same

chromosome that determines gender. More generally:

• Other characteristics are also sometimes associated because, as paired chromosomes separate during germ cell development, genes proximate to one another tend to remain together. But sometimes, as a mechanistic consequence of reproduction, this linkage between genes is broken, allowing for new combinations of traits.

Morgan's experimental and theoretical work inaugurated research in genetics and promoted a revolution in biology. Evidence he adduced from embryology and cell theory pointed the way toward a synthesis of genetics with evolutionary theory. Morgan himself explored aspects of these developments in later work, including *Evolution and Genetics* published in 1925, and *The Theory of the Gene* in 1926. He received the Nobel Prize in Physiology or Medicine in 1933.

Back to GNN Home Page

08.3 Sam Barrus Res Subunit Vocabulary List

Overall list of vocabulary for the unit.

1. Gregor Mendel
2. incomplete dominance
3. codominance
4. testcross
5. multiple alleles (blood type)
6. Chi Squares and degrees of freedom
7. pleiotrophy
8. epistasis
9. polygenetic inheritance
10. expressivity
11. penetrance
12. locus
13. “wild type” (flies)
14. “mutant type”
15. sex-linked genes
16. autosome
17. sex chromosome
    hemizygous
18. Thomas Hunt Morgan
19. linkage
20. linkage map
21. map units
22. translocation
23. recombination/recombination frequency
24. genomics
25. epigenetics

08.4 Sam Barrus Res Discussion Rubric

Name: Date:

Biology CP 11: Genetics Unit
Subunit: Beyond Mendel

Category	Standard	Points Worth	Points Earned	Comments
Organization (20 points)	Is your discussion appropriate for the topic and the audience?	5		
	Is your information presented in a logical order?	5		
	Is the poster neat and visually appealing?	10		
Content (60 points)	Do you clearly define your term using relevant vocabulary?	15		
	Did you provide enough additional scientific information for the audience to understand the concept?	15		
	Did you differentiate your term from other similar terms from the unit?	10		
	Did you explicitly describe the term's effect on both genotype and phenotype and give examples?	10		
	Did you incorporate visual aids to add to your presentation and aid in explanation?	10		
Presentation (20 point)	Did you appear prepared and comfortable with the information?	5		
	Did you speak loudly and clearly?	5		
	Were you able to respond to questions from other students?	10		
	Total	100		

:

09 LP Sam Barrus-Epigenetics

Overview: This is the final lesson in the Beyond Mendel subunit; students to this point have learned about the spectrum of dominance, other origins of genetic variance through gene interaction, and have gotten a brief introduction to the concept of mapping chromosomes. Today, we will cover material on epigenetics by using resources like a photo set, a video, and an online module.

Standards (Links)
09 Sam Barrus Content Standard-2b

Objectives
Students will be able to…
1.identify environmental factors that contribute to the alteration of DNA
2.explain why identical twins look more unique as they age
3.manipulate the epigenome of a rat through an interactive module

Materials / Preparation Notes

Plans to differentiate instruction: This lesson uses a variety of methods to allow all students to learn the material.

- Genetics Bingo!: kinesthetic, auditory, visual-spatial learners
- Photo set: visual-spatial learners
- Video: auditory, visual-spatial learners
- Module: intrapersonal, kinesthetic, auditory, visual-spatial learners
- Response Questions: linguistic, visual-spatial, logical-mathematical, intrapersonal learners

Accommodations and Modifications:
ADHD: review instructions to check for understanding, extra time to go over module, work 1:1 with the student often, help organizing of portfolio

Specific Learning Disability (Reading): interactive module has much of text following oral instructions, computer to type out responses, video and photos represent key concepts in material

Physical Disability (mild hearing loss): able to listen to video on personal computer with headphones for video and interactive module. Speak loudly/clearly (or offer paper copy) when giving instruction, repeat instructions 1:1 to the student while transitioning to new activities.

Environment factors:
Grade:11th Grade CP
Students:22 kids: 12 boys, 10 girls
Grouping:heterogeneous
Room set up: initially standard set up of desks in rows for bingo, video, photo set, for activity shift to computer lab for module, then back to the original for closing discussion.

Timing:(20 minutes genetics bingo)(15 minutes video with notes) (50 mins independent work) (10 min closing to check for understanding/asking questions)

Materials:

- Projector
- Use of computer lab
- Handouts (links below)

07/08/09.0 Sam Barrus Res- Word Family Tree Sheet
09.1 Sam Barrus Res-Genetics Bingo Card
09.2 Sam Barrus Res-Epigenetics Questions

Instruction

Opening:

1. **Hook: Genetics Bingo!**Students should have filled out this card from the vocabulary list prior to coming to class. In 20 minutes, we can probably have three rounds. I call definitions of terms and they try to match it to the correct word on their cards.
2. **Opening Discussion:**I will ask the class if anyone is an identical twin, or knows someone who is (I expect the answer to be yes); if I asked why they look identical, but this stage students would explain it is due to the fact they got identical genetic material, meaning they have the same expression of their genes. I can then bring up the slide show from National Geographic that came from an article on epigenetics to show while identical twins can look very similar, their environment and life choices can change their DNA.**09.3 Sam Barrus Res-Twins Portrait Gallery National Geographic Magazine**

Activities:

1. **Thirteen minute video**on epigenetics with thought questions to begin noting points from the video or photo sets.09.4 Sam Barrus Res-NOVA | Epigenetics

2. **Interactive module**on the creation of an epigenome in a newborn rat. Students are able to explore the module and learn how physiological changes are happening on many levels (personality, brain cell, DNA levels) in relation to the quality of their environment directly after birth.09.6 Sam Barrus Res-Rat Epigenome Module
   Extra Resource:09.5 Sam Barrus Res Identical Twins: Pinpointing Environmental Impact on the Epigenome

Closing: Come back together as a class and discuss the thought questions or answer other questions about the material. Additional questions might be:

- *What activity today helped you learn the material the best? Why?*
- *What is one thing you found interesting from the module that was from a source not included under the Newborn Rat section?*
- *Did it help to answer any of your assigned questions?*
- *If you were able to write one question that you think is very important to understanding epigenetics that I hadn't included, what would it be?*

I think I would have students write a response to the last question above as an exit slip, so I can figure out issues or misunderstandings to address before moving on to the next subunit and how well my lesson was presented to address the key concepts. Portfolios are due next class.

Assessment Notes:

Formative: class participation and quality of independent work session, exit slip
Summative: Thought questions due next period in portfolio

09 Sam Barrus Content Standard-2b

Source URL: https://riscienceteachers.wikispaces.com/LS1+%289-11%29+-+2

LS1 (K-4) SAE -2	LS1 (5-8) SAE+FAF –2	LS1 (9-11) FAF+ POC -2
Identify the basic needs of plants and animals in order to stay alive. (i.e., water, air, food, space).	*Describe or compare how different organisms have mechanisms that work in a coordinated way to obtain energy, grow, move, respond, provide defense, enable reproduction, or maintain internal balance (e.g., cells, tissues, organs and systems).*	*Explain or justify with evidence how the alteration of the DNA sequence may produce new gene combinations that make little difference, enhance capabilities, or can be harmful to the organism (e.g., selective breeding, genetic engineering, mutations).*

Students demonstrate an understanding of the molecular basis for heredity by …

2a describing the DNA structure and relating the DNA sequence to the genetic code.

2b explaining how DNA may be altered and how this affects genes/heredity (e.g. substitution, insertion, or deletion).

2c describing how DNA contains the code for the production of specific proteins.

GSE LS1 (9-11)-2

Assessment target: Explain or justify with evidence how the alteration of the DNA sequence may produce new gene combinations that make little difference, enhance capabilities, or can be harmful to the organism (e.g., selective breeding, genetic engineering, mutations).
Students demonstrate an understanding of the molecular basis for heredity by …

- **2a describing the DNA structure and relating the DNA sequence to the genetic code**
- **2b explaining how DNA may be altered and how this affects genes/heredity (e.g. substitution, insertion, or deletion).**
- **2c describing how DNA contains the code for the production of specific proteins.**

From the RISTA Workshop, December 2009.

H

RISTA Workshop: Unpacking the GSEs

Group Information

Name	Academic Level (E/M/H)	School
Sheila Rolland	H	St Mary Academy Bay View
Julie Malone		Westerly
Bill Varden Physics		Westerly
Richard Powell Physics		NKHS
Karen Finlaw		NKHS
Janell Johnson		St. Mary Academy Bay View

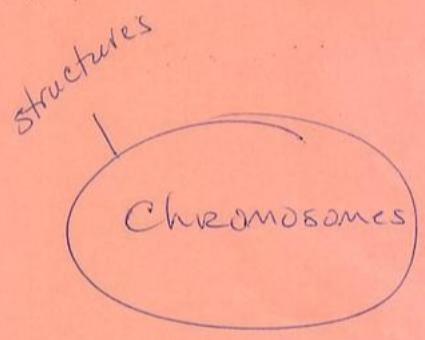
GSEs:

Life Science	Physical Science	Earth Science
• LS1 (9-11) -1: Cell structure and Function • LS1 (9-11)-2: Genetics • LS2 (9-11)-3: Ecosystem Equilibrium • LS2 (9-11)-4: Energy Flow & Chemical Reactions • LS2 (9-11)-5: Scientific Data and Evidence • LS3 (9-11)-6: Genetic Variation • LS 3 (9-11)-7: Natural Selection • LS3 (9-11)-8: Patterns & Mechanisms of Evolution • LS4 (9-11)-9: Human Impact on the Environment, Genetic Mutations • LS4 (9-11)-10: Human Phys	• PS1 (9-11)-1: Ideal Gas Law • PS1 (9-11)-2: Atomic Theory • PS1 (9-11)-3: Periodic Table • PS (9-11)-4: Predicting Reaction Products • PS2 (9-11) -5: Energy Transfer • PS2 (9-11) -6: Chemical Reactions • PS3 (9-11)-7: Magnetic Fields • PS3 (9-11) -8: Motion • PS3 (9-11) -9: Forces • PS3 (9-11) -10: Wavelengths	• ESS1 (9-11) -1: Earth Topography & Climate • ESS1 (9-11) -2: Plate Tectonics & Technology • ESS1 (9-11) -3: Rock Cycle & Formation • ESS1 (9-11) -4: Radiometric Dating & Fossil Records • ESS3 (9-11) -5: Evolution of Solar System • ESS3 (9-11) -6: Big Bang Theory/Astronomy • ESS3 (9-11) -7: Properties of Wave/Particles • ESS3 (9-11) -8: Life Cycles of Stars

Step 1: What does this GSE mean?

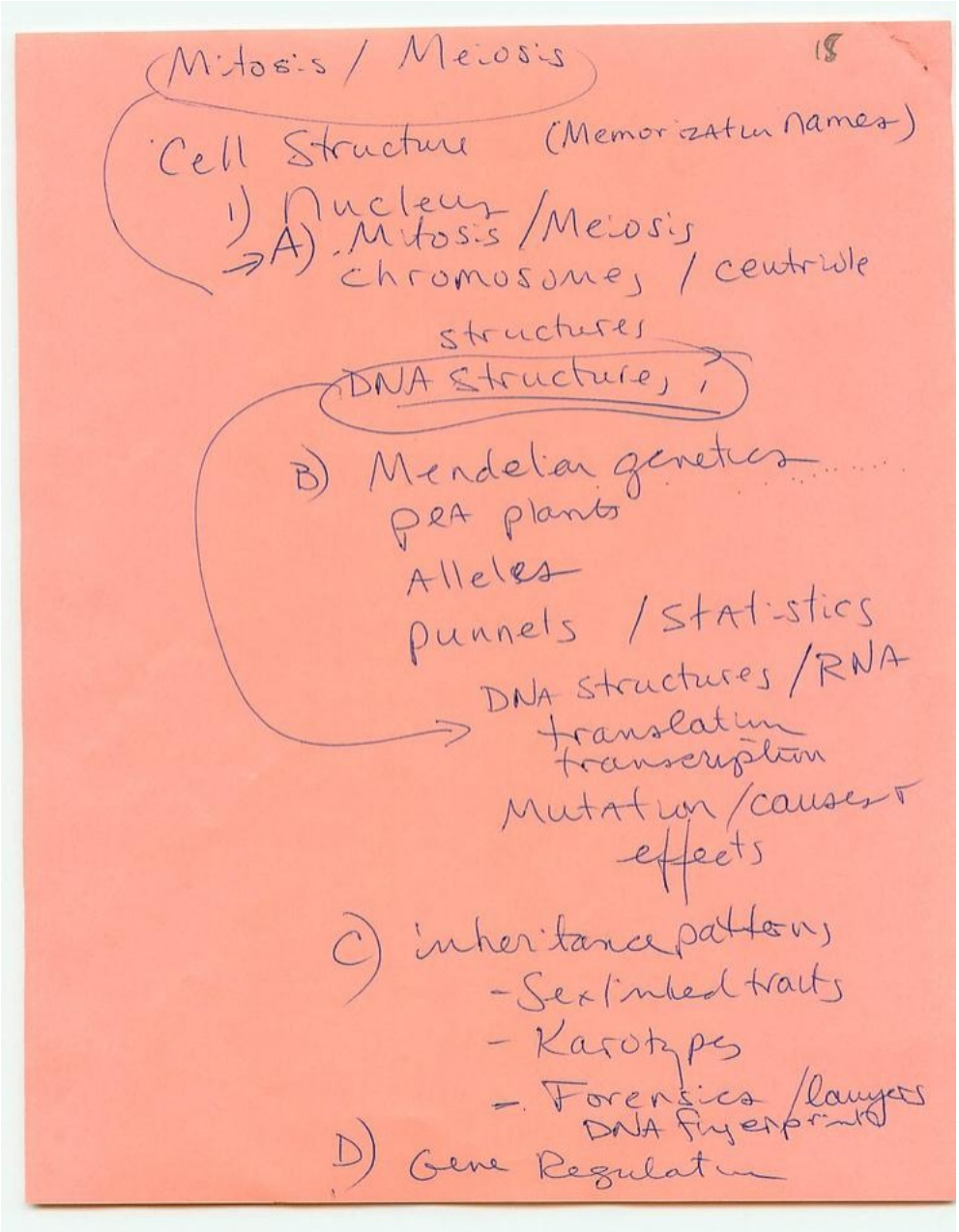
Choose a GSE that you care about teaching, read it carefully, brainstorm, and organize the topics and subtopics that you feel are necessary for students to understand.

GSE:

1. What topics (and subtopics) are contained in this GSE?	2. After your initial brainstorm, rearrange your topics into either an outline (below) or a concept map (on back).
DNA fingerprints Karotyping ✓ Cell Structure ✓ Mitosis ✓ Micosis ✓ DNA ✓ / RNA Chromosomes ✓ Punnet ✓ alleles ✓ Statitics Mendelian genetics Causes of Mutations	

Be prepared to share:

gene regulation
transcription ✓
translation ✓



Concepts contained in 2a:

- DNA is found in chromosomes, which are in the nucleus. DNA is smaller than the nucleus and the cell.
- DNA is a double helix, like twisted ladders, 98% of which is not genes (in humans).
- DNA is enormous, for a molecule, but still really small. Sense of relative scale.
- DNA is made of long chains of small chemical units called nucleotide bases.
- The order of the nucleotide bases in DNA carries information, like the order of letters in words and sentences.
- There are only four ‘letters’ in the DNA alphabet, g, a, c, t, and they pair in the double helix as g-c, a-t.
- Groups of three letters are read as ‘words’ called codons. Each codon codes for an amino acid.

Concepts contained in 2b:

- What are the kinds of mutations, frame shift, addition, subtraction, substitution?
- What are the effects of those mutations? No effect. Effects that are passed on, effects that are advantageous, effects that are disadvantageous, fatal

effects.
- Where and when will mutations matter? Mutations in gametes can be passed on, otherwise not. Some mutations do not change amino acids, due to synonomous codons. Sometimes, mutations have no effect on protein function.

Concepts conatined in 2c:

- DNA is transcribed into a portable molecule called RNA
- messenger RNAs carry instructions for making a protein
- ribosomal RNA makes up a large part of the protein making machines, ribosomes
- transfer RNAs bring amino acids to the protein making machinery
- RNA messages are translated into proteins
- Students need to be able to code and decode DNA into amino acids
- Students should know the special codes for stop and start
- Teachers should learn about introns and exons, and how the coding of DNA is an interrupted process. Eukaryotic gene sequences are not continuous.

What ideas to students need to understand before they can address the topics described above?

Students need to know":

- that differences between organisms are important, and do matter.
- Organisms that are more fit will tend to survive and reproduce more often.
- Transcription and translation processes.

What misconceptions are students likely to have about these topics?

Students often believe (erroneously):

- Mutations are always bad,
- mutations cause super powers,
- mutations are the same as cancer.
- Students misunderstand scale of DNA.

What phenomena and representations help students understand these topics?

- 3-D models are important to understand double helix structure.
- Have students make mutations to DNA.

What activities or activity sequences can be used to address these GSEs?

- students build model of DNA from paper or clay
- Connects has a DNA model
- Students send mesages in amino acid form, coding and decoding.
- Students will research a particular mutation, and find out the effects.(We will provide list of disorders, cystic fibrosis, polydactly, albinism, sickle-cell anemia, etc….)

09.1 Sam Barrus Res-Genetics Bingo Card

PDF Attachment

09.2 Sam Barrus Res-Epigenetics Questions

PDF Attachment

09.3 Sam Barrus Res-Twins Portrait Gallery National

Geographic Magazine

Source URL: http://ngm.nationalgeographic.com/2012/01/twins/schoeller-photography#/1

Six-year-old Johanna Gill puts a protective hand on her sister, Eva. The twins both have mild autism, a disorder linked to genetic inheritar

09.4 Sam Barrus Res-NOVA | Epigenetics

Source URL: http://www.pbs.org/wgbh/nova/body/epigenetics.html

NOVA scienceNOW

Epigenetics

Posted 07.24.07 | NOVA scienceNOW

Once nurture seemed clearly distinct from nature. Now it appears that our

diets and lifestyles can change the expression of our genes. How? By influencing a network of chemical switches within our cells collectively known as the epigenome. This new understanding may lead us to potent new medical therapies. Epigenetic cancer therapy, for one, already seems to be yielding promising results.

LAUNCH VIDEO

Running Time: 13:02

Transcript

Epigenetics

PBS air date: July 24, 2007

CHEERFULNEIL DEGRASSE TYSON: Did you evernotice that if you get to know two identical twins, they might look alike, butthey're always subtly different?

CANTANKEROUSNEIL DEGRASSE TYSON: Yep, whatever.

CHEERFULNEIL DEGRASSE TYSON: As they getolder, those differences can get more pronounced. Two people start out the samebut their appearance and their health can diverge. For instance, you have moregray hair.

CANTANKEROUSNEIL DEGRASSE TYSON: No. No, Idon't. Identical twins have the same DNA, exact same genes.

CHEERFULNEIL DEGRASSE TYSON: Yeah.

CANTANKEROUSNEIL DEGRASSE TYSON: Anddon't our genes make us who we are?

CHEERFULNEIL DEGRASSE TYSON: Well they do,yes, but they're not the whole story. Some researchers have discovered anew bit of biology that can work with our genes or against them.

CANTANKEROUSNEIL DEGRASSE TYSON: Yeah,you're heavier, and I'm better looking.

CHEERFULNEIL DEGRASSE TYSON: Yeah,whatever.

NEIL DEGRASSE TYSON: Imagine coming intothe world with a person so like yourself, that for a time you don'tunderstand mirrors.

CONCEPCIÓN: As a child, when I looked in the mirrorI'd say, "That's my sister." And my mother would say,"No, that's your reflection!"

NEIL DEGRASSE TYSON: And even if youresist this cookie-cutter existence, cultivate individual styles andabilities—like cutting your hair differently, or runningfaster—uncanny similarities bond you together: facial expressions, bodylanguage, the way you laugh—or dress for an interview, perhaps, when youhadn't a clue what your sister was going to wear. The synchrony in yourlives constantly confronts you.

CLOTILDE: When I see my sister, I see myself. If she looksgood, I think, "I look pretty today." But if she's notwearing makeup, I say, "My god, I look horrible!"

NEIL DEGRASSE TYSON: It's hardlysurprising because you both come from the same egg. You have precisely the samegenes. And you are literally clones, better known, as identical twins.

Butnow, imagine this: one day, your twin, your clone, is diagnosed with cancer. Ifyou're the other twin, what can you do except wait for the symptoms?

CLOTILDE: I have been told that I am a high risk for cancer.Damocles' sword

hangs over me.

NEIL DEGRASSE TYSON: And yet, it'snot uncommon for a twin, like Ana Mari, to get a dread disease, while theother, like Clotilde, doesn't. But how can two people so alike, be sounalike?

Well,these mice may hold a clue. Their DNA is as identical as Ana Mari andClotilde's despite the differences in their color and size. The human whostudies them is Duke University's Randy Jirtle.

So,Randy, I see here you have skinny mice and fat mice. What have you done in thislab?

RANDYJIRTLE: Well,these animals are actually genetically identical.

NEIL DEGRASSE TYSON: The fat ones andthe skinny ones?

RANDYJIRTLE: That'scorrect.

NEIL DEGRASSE TYSON: Because these arehuge.

RANDYJIRTLE: They'rehuge.

NEIL DEGRASSE TYSON: Can we weigh themand find out?

RANDYJIRTLE: Sure. Soif you take this...

NEIL DEGRASSE TYSON: It looks like theycan barely walk.

RANDYJIRTLE: Theycan't walk too much. They're not going to be running very far. Sothat's about 63 grams.

NEIL DEGRASSE TYSON: 63 grams.

RANDYJIRTLE: Let'slook at the other one.

NEIL DEGRASSE TYSON: So it's halfthe weight.

RANDYJIRTLE: Right.

NEIL DEGRASSE TYSON: This gets even moremysterious when you realize that these identical mice both have a particulargene, called agouti, but in the yellow mouse it stays on all the time, causingobesity.

Justlook at this.

Sowhat accounts for the thin mouse? Exercise? Atkins? No, a tiny chemical tag ofcarbon and hydrogen, called a methyl group, has affixed to the agouti gene,shutting it down. Living creatures possess millions of tags like these. Some,like methyl groups, attach to genes directly, inhibiting their function. Othertypes grab the proteins, called histones, around which genes coil, and tightenor loosen them to control gene expression. Distinct methylation and histonepatterns exist in every cell, constituting a sort of second genome, theepigenome.

RANDYJIRTLE: Epigeneticsliterally translates into just meaning "above the genome." So ifyou would think, for example, of the genome as being like a computer, thehardware of a computer, the epigenome would be like the software that tells thecomputer when to work, how to work, and how much.

NEIL DEGRASSE TYSON: In fact, it'sthe epigenome that tells our cells what sort of cells they should be. Skin?Hair? Heart? You see, all these cells have the same genes. But their epigenomessilence the unneeded ones to make cells different from one another. Epigeneticinstructions pass on as cells divide, but they're not necessarilypermanent. Researchers think they can change, especially during criticalperiods like puberty or pregnancy.

Jirtle'smice reveal how the epigenome can be altered. To produce thin, brown miceinstead of fat, yellow ones, he feeds pregnant mothers a diet rich in methylgroups to form the tags that can turn genes off.

RANDYJIRTLE: And Ithink you can see that we dramatically shifted the coat color and we get many,many more brown animals.

NEIL DEGRASSE TYSON: And that mattersbecause your coat color is a tracer, is an indicator...

RANDYJIRTLE: That'scorrect.

NEIL DEGRASSE TYSON: ...of the factthat you have turned off that gene?

RANDYJIRTLE: That'sright.

NEIL DEGRASSE TYSON: This epigenetic fixwas also inherited by the next generation of mice, regardless of what theirmothers ate. And when an environmental toxin was added to the diet instead ofnutrients, more yellow babies were born, doomed to grow fat and sick like theirmothers.

Itseems to me, this has profound implications for our health.

RANDYJIRTLE: It does,for human health. If there are genes like this in humans, basically, what youeat can affect your future generations. So you're not only what you eat,but potentially what your mother ate, and possibly even what your grandparentsate.

NEIL DEGRASSE TYSON: So how do you go tohumans to do this experiment, when you have these mice, and they'regenetically identical on purpose?

RANDYJIRTLE: That'sright.

NEIL DEGRASSE TYSON: So, who is yourperfect lab human?

RANDYJIRTLE: Well, thenwe look for identical humans, which are identical twins.

NEIL DEGRASSE TYSON: Twins, twins.

Andthat brings us to the reason why we're showing you Spanish twins. In2005, they participated in a groundbreaking study in Madrid. Its aim? To showjust how identical, epigenetically, they are or aren't.

MANELESTELLER (Spanish National Cancer Center): One of the questions of twins is, "If my twinhas this disease, I will have the same disease?" And genetics tell us thatthere is a high risk of developing the same disease. But it's not reallysure they are going to have it, because our genes are just part of the story.Something has to regulate these genes, and part of the explanation isepigenetics.

NEIL DEGRASSE TYSON: Esteller wanted tosee if the twins' epigenomes might account for their differences. To findout, he and his team collected cells from 40 pairs of identical twins, agethree to 74, then began the laborious process of dissolving the cells until allthat was left were wispy strands of DNA, the master molecule that contains ourgenes.

Next,researchers amplified fragments of the DNA, until the genes themselves becamedetectable. Those that had been turned off epigenetically appear as dark pinkbands on the gel. Now, notice what happens when the genes from a pair of twinsare cut out and overlapped.

Theresults are far from subtle, especially when you compare the epigenomes of twosets of twins that differ in age. Here, on the left, is the overlapped DNA ofsix-year-old Javier and Carlos. The yellow indicates where their geneexpression is identical.

Onthe right, is the DNA of 66-year-old Ana Mari and Clotilde. In contrast to theyounger twins, hardly any yellow shines through. Their epigenomes have changeddramatically.

Thestudy suggests that, as twins age, epigenetic differences accumulate,especially when their lifestyles differ.

MANELESTELLER: One of the main findings of ourresearch is that epigenomes can change in function of what we eat, of what wesmoke, of what we drink. And this is one of the key differences betweenepigenetics and genetics.

NEIL DEGRASSE TYSON: As the chemicaltags that control our genes change, cells can become abnormal, triggeringdiseases like cancer. Take a disorder like MDS, cancer of the blood and bonemarrow. It's not a diagnosis you'd ever want to hear.

SANDRASHELBY: When I went in, he started pattingmy hand, and he was going, "Your blood work does not look very good atall," and that I had MDS leukemia, and that there was not a cure for it.And, basically, I had six months to live.

NEIL DEGRASSE TYSON: Was epigenetics thereason? Could the silencing of critical genes turn normal cells into cancerousones? It's scary to think that a few misplaced tags can kill you. Butit's also good news, because we've traditionally viewed cancer as adisease stemming solely from broken genes. And it's a lot harder to fixdamaged genes than to rearrange epigenetic tags. In fact, we already have a fewdrugs that will work. Recently, Sandra Shelby and Roy Cantwell participated inone of the first clinical trials using epigenetic therapy.

JEAN PIERREISSA (M.D. Anderson Cancer Center): The idea of epigenetic

therapy is to stay away fromkilling the cell. Rather, what we are trying to do is diplomacy, trying tochange the instructions of the cancer cells, reminding the cell, "Hey,you're a human cell. You shouldn't be behaving this way." Andwe try to do that by reactivating genes.

SANDRASHELBY: The results have been incredible, andI didn't have really any horrible side effects.

ROYCANTWELL: I am in remission. And going inthe plus direction is a whole lot better than the minus direction.

NEIL DEGRASSE TYSON: In fact, half thepatients in the trial are now in remission. But, while it maybe easier to fixour epigenome than our genome, messing it up is easier, too.

RANDYJIRTLE: We'vegot to get people thinking more about what they do. They have a responsibilityfor their epigenome. Their genome they inherit. But their epigenome, theypotentially can alter, and particularly that of their children. And that bringsin responsibility, but it also brings in hope. You're not necessarilystuck with this. You can alter this.

▸ Credits

▸ Participants

09.5 Sam Barrus Res Identical Twins: Pinpointing Environmental Impact on the Epigenome

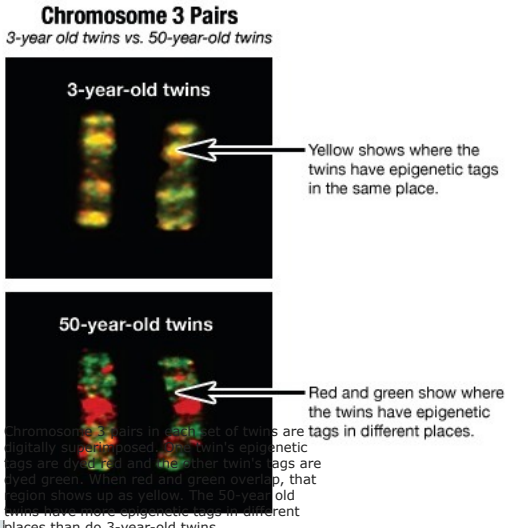
Source URL: http://learn.genetics.utah.edu/content/epigenetics/twins/

IDENTICAL TWINS: PINPOINTING ENVIRONMENTAL IMPACT ON THE EPIGENOME

Because identical twins develop from a single zygote, they have the same genome. This removes genetics as a variable telling scientists that the differences they observe between the individuals are caused almost solely by environmental factors. Recent studies have shown that many of these environmentally induced differences are acquired via the epigenome.

Nature AND Nurture

The insight we gain from studying twins helps us to better understand how nature and



Chromosome 3 pairs in each set of twins are digitally superimposed. One twin's epigenetic tags are dyed red and the other twin's tags are dyed green. When red and green overlap, that region shows up as yellow. The 50-year-old twins have more epigenetic tags in different places than do 3-year-old twins.

nurture work together. For well over a century, researchers have compared characteristics in twins in an effort to determine the extent to which certain traits are inherited, like eye color, and which traits are learned from the environment, such as language. Typically taking place in the field of Behavioral Genetics, classical twin studies have identified a number of behavioral traits and diseases that are likely to have a genetic component, and others that are more strongly influenced by the environment.

Depending on the study and the particular trait of interest, data is collected and compared from identical or fraternal twins who have been raised together or apart. Finding similarities and differences between these sets of twins is the start to determining the degree to which nature and environment play a role in the trait of interest.

Twin studies have identified some traits that have a strong genetic component, including reading disabilities like dyslexia. Other traits, like arthritis, are more likely influenced by the environment.

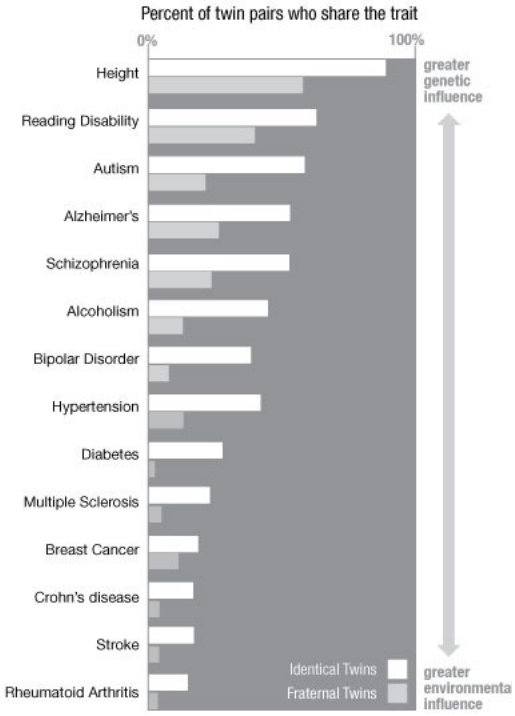
Identical twins (left) share all their genes and their home environment. Fraternal twins (right) also share their home environment, but only half of their genes. So a greater similarity between identical twins for a particular trait compared to fraternal twins provides evidence that genetic factors play a role.

Twin Studies Help Link Environment and Complex Traits

The advancing field of Molecular Genetics has given us new tools to use when examining traits in twins. Because they are genetically the same but their environments become more unique as they age, identical twins are an excellent model for studying how environment and genes interact. This has become increasingly important when studying complex behaviors and diseases.

For example, when only one identical twin in a pair gets a disease, researchers look for elements in the twins' environments that are different. Data is collected and compared for large numbers of affected twins and coupled with DNA and gene product analysis. These types of twin studies can help pinpoint the exact molecular mechanism of a disease and determine the extent of environmental influence. Having this information can lead to the prevention and treatment of complex diseases.

To illustrate, for twin pairs where schizophrenia occurs, in 50% of cases both identical twins in a pair develop the disease, while only 10-15% of cases in fraternal twins show this pattern. This is evidence for a strong genetic component in susceptibility to schizophrenia. However, the fact that both identical twins in a pair don't develop the disease 100% of the time indicates that there are other factors involved.



Comparing Identical and Fraternal Twins: A higher percentage of disease incidence in both identical twins is the first indication of a genetic component. Percentages lower than 100% in identical twins indicates that DNA alone does not determine susceptibility to disease.

References

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Poulsen P., Esteller M., Vaag A., Fraga M.F. (2007) The Epigenetic Basis of Twin Discordance in Age-Related Diseases. Pediatric Research, 61: 38R-42R (subscription required).

09.6 Sam Barrus Res-Rat Epigenome Module

Source URL: http://learn.genetics.utah.edu/content/epigenetics/rats/

LICK YOUR RATS

Some mother rats spend a lot of time licking, grooming and nursing their pups. Others seem to ignore their pups. Highly nurtured rat pups tend to grow up to be calm adults, while rat pups who receive little nurturing tend to grow up to be anxious.

It turns out that the difference between a calm and an anxious rat is not genetic - it's epigenetic. The nurturing behavior of a mother rat during the first week of life shapes her pups' epigenomes. And the epigenetic pattern that mom establishes tends to stay put, even after the pups become adults.

Anxious Behavior Can Be an Advantage

In our society, we think of anxious behavior as being a disadvantage. But that's because, for the most part, we live in a nutrient-rich, low-danger environment. In the rat equivalent to our world, the relaxed rat lives a comfortable life. It is likely to reach a high social standing, and it doesn't have to worry about where its next meal is coming from. An anxious rat, on the

A Different Kind of Inheritance

We're used to thinking of inheritance in terms of the letters of the DNA code that pass to us from our parents -- through eggs and sperm. But the licking rat story tells us that there is another path to the offspring's DNA. Through her licking behavior, a mother rat can write information onto her pups' DNA in a way that completely bypasses eggs and sperm. In a sense, her nurturing behavior tells her pups something about the world they will grow up in. Mom's behavior actually programs the pups' DNA in a way that will make them more likely to succeed.

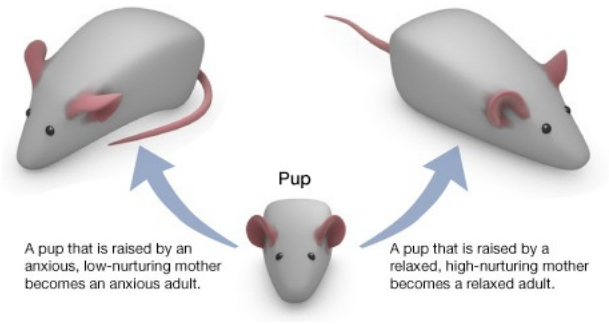
The epigenetic code gives the genome a level of flexibility that extends beyond the relatively fixed DNA code. The epigenetic code allows certain types of information to be passed to offspring without having to go through the slow processes of random mutation and natural selection. At the same time, the epigenetic code is sensitive to changing environmental conditions such as availability of food or threat from predators.

Epigenetic Patterns Are Reversible

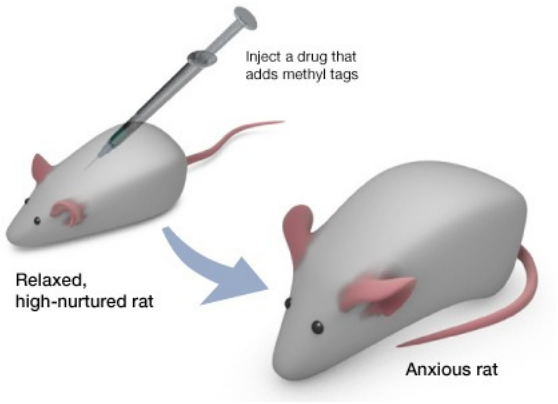
Gene expression patterns that are set up early in life are not necessarily stuck that way forever. You can take a low-nurtured rat, inject its brain with a drug that removes methyl groups, and make it act just like a high-nurtured rat. The GR gene gets turned on, cells make more GR protein, and the rat takes on a more relaxed personality. It works in the other direction too. You can take a relaxed, high-nurtured rat, inject its brain with methionine (a source of methyl) and make it more anxious. Of course drugs affect many genes, so they're not an exact substitute for maternal care. But it turns out that you can also turn an anxious rat into a more relaxed rat by spicing up its living quarters. So take heart -- your epigenetic destiny is not written in permanent ink.

other hand, doesn't do so well. It is more likely to have a low social standing and suffer from diabetes and heart disease.

In another environment, however, the tables turn. The anxious, guarded behavior of the low-nurtured rat is an advantage in an environment where food is scarce and danger is high. The low nurtured rat is more likely to keep a low profile and respond quickly to stress. In the same environment, a relaxed rat might be a little too relaxed. It may be more likely to let down its guard and be eaten by a predator.



High-nurturing mothers raise high-nurturing offspring, and low-nurturing mothers raise low-nurturing offspring. This may look like a genetic pattern, but it's not. Whether a pup grows up to be anxious or relaxed depends on the mother that raises it - not the mother that gives birth to it.



Based on a True Story

In a 2004 article, researchers at McGill University gave us some of the first clues about how social interactions help to shape the epigenome.

The study showed that there are epigenetic differences between high- and low-nurtured rats.

Most of the content on this page is based on the McGill study (see Weaver et al in the References section below).

< DOWNLOAD THIS MOVIE

Left: Dr. Moshe Szyf, Professor of Pharmacology and Therapeutics at McGill University, talks about high and low nurturing rats.

The Glucocorticoid Receptor (GR) Helps Shut Down the Stress Response

When we're confronted with danger, the body turns on stress circuitry in the brain. Stress circuitry activates the adrenaline-driven Fight or Flight response and causes the hormone cortisol to be released into the bloodstream. Cortisol is important for freeing stored energy, which helps with both fighting and fleeing. But too much cortisol can be a bad thing. High levels can lead to heart disease, depression, and increased susceptibility to infection.

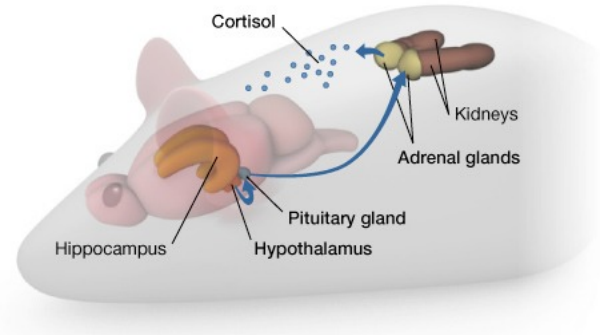
Cortisol also travels to an area of the brain called the hippocampus, where it binds to GRs. When enough cortisol is bound, the hippocampus sends out signals that turn off the stress circuit, shutting down both the Fight or Flight response and cortisol production.

Rats (and people) with higher levels of GR are better at detecting cortisol, and they recover from stress more quickly.

Learn more about the Fight or Flight response to stress:

HOW CELLS COMMUNICATE DURING THE FIGHT OR FLIGHT RESPONSE

AN EXAMPLE OF CELL COMMUNICATION: THE FIGHT OR FLIGHT RESPONSE



The Stress Circuit -- also called the HPA Axis (for Hypothalamus-Pituitary-Adrenal).

Stress signals travel from the hypothalamus to the pituitary gland and then to the adrenal glands. The adrenal glands release the hormone cortisol (and adrenaline, not shown).

When cells in the hippocampus detect cortisol, which binds to the GR receptor, they send a signal to the hypothalamus that shuts down the stress circuit.

References

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Jankard, R., & Herman, J.P. (2008). Limbic regulation of hypothalamo-pituitary-adrenocortical function during acute and chronic stress. Stress, Neurotransmitters, and Hormones: Annals of the New York Academy of Science, 1148, 64-73. EPIGENETICS

10 LP Jon Brown- Piecing Together Pedigrees

Author: colombiankid3

Overview:

This is the tenth lesson in the unit and the first lesson of the subunit of “Genetic disorders and how to identify them”. The lesson will focus on what a pedigree chart is and how to fill one out. The class will start with a brief review on past concepts and segway into a PowerPoint presentation detailing pedigree charts. After that, students will need to fill out two class worksheets on the material they just learned. A third worksheet will be given at the end of class for homework followed by an exit ticket they must complete before leaving class.

Standards (Links):

LS3 (9-11) 7

Objectives:

Students will be able to…

- Explain what a pedigree is and what it is used for.

- Utilize given information to create a properly labeled Pedigree.

Materials / Preparation Notes:

- White Board + Markers

- SmartBoard (Or similar) Projector

- PowerPoint Presentation

- Blank paper

- Appropriate amount of copies of Pedigree Class Worksheet

- Appropriate amount of copies of Pedigree Homework Worksheets

Opening:

As students enter the class that will begin the class routine by first dropping off their homework in the appropriate class homework bin. Next they will take their seats and begin the Do-Now written on the board. The Do-Now written will be: "***In the Do-Now Section of your notebook write down everything you can about dominant and recessive genes, as well as the passing of traits from parents to offspring. You have 5 minutes***." During these five minutes I will take attendance and check to see if everyone has completed their homework. If any student is missing their homework I will make a note of it and, depending on how often the student has missed homework in the past, question them about it. (If I have spoken to the student multiple times already I will not seek them out, as they need to learn to have responsibility. However, if the student were one who has not missed any assignments in the past I would ask them about the missing assignment. Perhaps they simply forgot to hand it in today or they have a legitimate excuse.) After the time for the quick write is up I will take a brief amount of time (3-5 minutes) on asking a few students to share what they have to see if people are missing any crucial information. I will tell students to write down anything they hear their classmates say that they didn't already have written down. I will finish the opening of class by answering any clarifying questions the students had about Dominant and Recessive Genes and the Passing of Traits.

Activities:

After the opening of class I will tell the students that today we will be learning what a Pedigree Chart is and how to fill one out. To start I will show the students a PowerPoint presentation outlining what a pedigree is and the various symbols associated with it. The PowerPoint will also explain why pedigree charts are important and how they are used in real life. I will tell the students to take notes on the presentation. As the PowerPoint reaches the section that defines each symbol I will remind my students to draw each symbol in their notes and write down what they mean. I will take care to try and see which students are actually taking notes and which are not. I will walk closer to the students that are not taking notes and if my proximity is not enough to get them too I will remind them again using their names.

After the PowerPoint is over I will have them split into pairs. Depending on how diligently they took notes during the PowerPoint I will either let them choose their own groups or will assign them groups using an app on my I-pad. Students will also have the option of working alone if they wish. Next I will give them the first part of the two-part classroom activity. The students will be given a sheet of paper that is half blank with the other half containing

details about a fictitious family. They will need to use these details to create and fill out a small pedigree chart. Since the pedigree they will need to create is short, they will be given only 5-10 minutes to complete it. After this time I will ask for a volunteer to draw the pedigree on the white board.

Once everyone has the correct pedigree drawn I will give the students a second worksheet to complete with the rest of class time. This worksheet will also be split into two parts. The upper half will contain a detailed and hopefully interesting little story that describes a family. Details on the family's history will be given as well as a problem that needs solving. The problem will have to do with finding out whether or not a child of the described couple will have a certain trait or disorder. The story will be fictitious and interesting enough to hold the attention of the students in the hopes that they will carefully read every part. In addition to this there will be a few questions to answer at the end of the worksheet. The students will spend the rest of class time working on completing the class worksheet. As students are working I will circulate the class answering questions and making sure everyone is working diligently.

Closing:

Eight minutes before the bell rings I will ask students to stop working. I will tell them that if they have not finished yet to finish the worksheet for homework. I will also hand out a third worksheet that is essentially the same format as the second worksheet but with a different scenario. I will tell the students that this worksheet is to be completed for homework in addition to finishing the other worksheet. I will then tell them to rip out a piece of paper from their notebooks to be filled out with the remaining class time as an exit ticket. The question they will need to answer will be this: "***What is a pedigree chart and what are they used for?***" The students will need to hand me this exit ticket before they will be allowed to leave.

Assessment Notes:

Formative: Whether or not students took notes. Class participation, completion of the first in-class worksheet, and the exit ticket.

Continuing: Completion of the second in-class worksheet as well as the worksheet assigned as homework.

Summative: Genetics test at the end of the unit.

10.1 Jon Brown, Pedigree Powerpoint

Author: colombiankid3

10.2 Jon Brown, Class Worksheets 1

Author: colombiankid3

10.3 Jon Brown, Pedigree Worksheet 2

Author: colombiankid3

10.4 Jon Brown, Pedigree Homework

Author: colombiankid3

10.5 Jon Brown, Link to standards for first lesson

Author: colombiankid3

https://risciencеteachers.wikispaces.com/LS3+p2

LS3 (9-11) 7

11 LP Jon Brown- Creating Karyotypes

Author: colombiankid3

Overview:

This is the eleventh lesson in the unit and the second lesson of the subunit of “Genetic disorders and how to identify them”. The lesson will focus on what a karyotype chart is and how they are used. The class will start by briefly reviewing what students know about chromosomes. Next a short video will be used as a hook. After that students will need to take notes on a Karyotype PowerPoint presentation. They will then need to partner up and complete an activity that requires them to create a karyotype. Class will end with me going over the online homework assignment followed by an exit ticket.

Standards (Links):

LS1 (9-11) 2b + 2aa

Objectives:

Students will be able to…

- Explain what a Karyotype is and what it is used for.
- Interpret karyotype charts to tell if someone has a genetic disorder

Materials / Preparation Notes:

- White Board + Markers
- SmartBoard (or similar) Projector
- PowerPoint Presentation
- “Hook” Video
- Appropriate amount of copies of cutout chromosomes
- Appropriate amount of copies of activity worksheets
- Blank (computer or notebook) Paper and Glue sticks

Opening:

As students enter the class they will begin the class routine. On the board the directions will say to pass in the worksheet they got last night for homework but to keep out the worksheet that they started in class yesterday. They will then need to begin the Do-Now, which will be written on the board: "***In the Do-Now section of your notebook write down everything you can remember from past lessons about chromosomes. You will have five minutes***." During these five minutes I will take attendance while simultaneously checking to see that they have the completed worksheet out that was started in the last class. After they have finished the quick-write I will spend a few minutes, (5 at the most) asking students what they wrote. I will tell them to write down anything another student had that they did not. After this short discussion I will show the students a brief video that shows actual footage of chromosomes under a microscope. I will use this video to try and peak the students' interest and will stress upon them how amazing it is that we can view chromosomes in the modern age. The video also features soothing music that will hopefully enhance the images.

Activities:

After the opening of class I will tell the students that today we will be learning about karyotypes. I will then ask if anyone already knows what a karyotype is and if any student raises their hand I will ask them to briefly explain what they think it is to the class. Next I will show the students a PowerPoint presentation that will contain information about what a karyotype is, how they are made, and what they are used for. The PowerPoint will also briefly go over chromosome structure. This section is just a refresher for students, as they should have already learned about chromosomes earlier in the unit. Genetic disorders will also be mentioned in the PowerPoint as they relate to karyotypes. I will tell the students that we will be discussing genetic disorders more in depth during the next class. My Students will be required to take notes on the PowerPoint Presentation.

Once the PowerPoint has finished we will move on to the classroom activity of the day. I will split students into partners. Again, I will only allow them to pick their own partners if they took notes on the PowerPoint diligently. Next, I will give every group of students an envelope. I will tell them not to open the envelope until I have explained the activity. The envelope will contain a folded piece of paper that contains multiple pictures of karyotypes for various genetic disorders. The envelope will also contain cutouts of 46 different chromosomes. The activity will require the pairs to use the cutouts to complete a Karyotype (using glue sticks and a separate piece of paper) and once completed they will need to answer the two questions that I will write on the board: ***1. What genetic disorder (if any) does your karyotype show? 2. Is your karyotype of a man or a woman?***I will tell them that to make things interesting this assignment will be treated as a race. The first pair to complete their karyotype and correctly answer the questions will receive two homework passes (one for each student in the pair) to be used on acceptable homework assignments. This means I would not accept a pass for a project due for homework but I would accept it for a worksheet. I will make this clear to the winning students when I give them the pass. Students will need to finish the assignment even after a winner has been declared. While students are working on the assignment I will circulate the room answering questions and making sure everyone is working diligently.

Closing:

Once all of the students are finished (if they did not all finish I will have them stop and finish it for homework) I will explain the homework assignment. They are to complete an activity online that involves karyotypes. I will write the URL on the board and tell them they can also find it on the class webpage. I will also tell them they do not have to complete the last part of the activity on genetic disorders, as we will not be learning about genetic disorders until the next class. They will need to write down the answers from the website down on a separate piece of paper to be turned in next class. If they did not finish the in-class assignment, that will also need to be completed for homework. Finally, they will need to complete an exit ticket on a blank piece of paper before they can leave for class: "***What is a karyotype and why are they important?"***

**For students who do not have access to a computer, special circumstances must be allowed for. One possible solution could be arranging for a student to use a school computer after school. They could also potentially be given extra time on the assignment.*

Assessment Notes:

Formative: Whether or not students took notes. Class participation, completion of the in class assignment, and the exit ticket.

Continuing: Completion of the online homework assignment.

Summative: Genetics test at the end of the unit.

11.1 Jon Brown, Karyotype PowerPoint

Author: colombiankid3

11.2 Jon Brown, Karyotype Worksheet

Author: colombiankid3

11.3 Jon Brown, Karyotype Assignment Materials Picture

Author: colombiankid3

11.4 Jon Brown, Link to Karyotype Homework Online Assignment

Author: colombiankid3

http://www.biology.arizona.edu/human_bio/activities/karyotyping/patient_a/final_noform.html

11.5 Jon Brown, Link to hook video

Author: colombiankid3

http://www.youtube.com/watch?v=E0WkZr819UU

11.6 Jon Brown, Link to standards for second lesson

Author: colombiankid3

https://risciencеteachers.wikispaces.com/LS1+p2

LS1 (9-11) 2b + 2aa

12.0 LP Jon Brown- Diagnosing Genetic Disorders

Author: colombiankid3

Overview:

This is the twelfth lesson in the unit and the third lesson of the subunit “Genetic disorders and how to identify them”. The lesson will focus on what causes a genetic disorder and also will go over a few key genetic disorders. Symptoms and what causes the disorder will be emphasized. The class will start with an assessment of the previous night’s homework followed by a hook video. Next a PowerPoint will be utilized to teach students the material on genetic disorders. The rest of class time will be spent with students working on a three-part assignment that will need to be finished at home. The assignment will cover pedigrees, karyotyping, as well as genetic disorders. At the end of class I will remind students to start studying for the unit test.

Standards (Links):

LS1 (9-11) 2b + 2c + 2aa

Objectives:

Students will be able to…

-Explain what a genetic disorder is and explain what causes them.

- Identify several genetic disorders and list a few symptoms of each.

Materials / Preparation Notes:

- White Board + Markers

- SmartBoard (or similar) Projector

- PowerPoint Presentation

- “Hook” Video

- Appropriate amount of copies of the class assignment worksheet

- Computers available for class assignment

- Blank paper (computer or notebook)

Opening:

As students enter the class they will begin the class routine. They will need to pass in the previous nights assignment in the correct bin before sitting down and beginning the Do-Now assignment on the board: “***On a blank piece of notebook paper I want you to tell me what you thought of the online assignment last night. How long did it take? Did you find it helpful? You will have five minutes.”*** This Do-Now will be collected and provide me with feedback on the previous nights’ online homework assignment. This will help me decide if I should continue to use this assignment in future classes. While the students finish this I will take attendance and watch to see that everyone turns in their homework assignment. After I collect the Do-Now papers I will show the class segments of a video on genetic disorders. I will not show the whole video, as it is too long. I feel that this video really shows how crazy it is that the tiniest little change in our genetic code can have huge repercussions. I will try and stress how amazing it is that we as a species have figured out which genes cause which genetic disorders. Hopefully this video will act as a hook to peak the students’ interests about this subject.

Activities:

After the opening of class I will remind students that today we will be learning about what causes a genetic disorder. We will also discuss a few major genetic disorders. I will then show the students a PowerPoint Presentation that will contain the relevant information on genetic disorders. The PowerPoint will begin with identifying what a genetic disorder is as well as what causes them. Then it will contain information about several genetic disorders, including which chromosome impacts which disorders as well as symptoms of each. As usual students will be expected to take notes on the PowerPoint. I will remind them to be specific with the notes on the various disorders and tell them to write down all the symptoms as well as what chromosomes are associated with them.

Once the PowerPoint has finished we will move on to the classroom activity of the day. This activity will be a bit longer than some of the past activities and therefore will require the rest of the class period and most likely additional work for homework. The assignment will have three parts and will act as a pre-summative assessment to what we learned in the last three classes. The main summative assessment will be the Unit Test that will be given

on a later class day. The assignment will be explained on a worksheet that I will distribute to the class. I will also go over the instructions after everyone has a worksheet. Students will be working in pairs on this assignment. I will assign the partners for this assignment regardless of how well the students took notes. Students will first need to interpret a karyotype to see what genetic disorder they will use for the rest of the activity. Next, they will need to fill out a pedigree chart that will tell them whether or not a certain family member will have this disorder. Finally, they will be required to do some online research (there are 12 computers available in my classroom) of the genetic disorder and present five facts about the disorder that were not discussed in class. They will also need to tell if there are any treatment options available for the disorder. The five facts as well as treatment information will be written down on a piece of notebook paper to be presented to the class on a later day.

Closing:

Five minutes before the bell rings I will have students wrap up what they are working on and return to their seats. I will tell them to complete this assignment for homework (Homework pass may not be used) and that no additional written work will be assigned. I will also tell them they should be starting to study for the unit test that will be given in a few days time. Lastly I will tell them that if anyone feels like they need some extra help with any of the topics from the genetics unit to email me and try to set up an appointment after school to go over what they are having trouble with. There will be no exit ticket given for this class.

Assessment Notes:

Formative: Whether or not students took notes. Class participation during in class assignment.

Continuing: Completion of the assignment that was started in class.

Summative: The genetics test to be given in a few days. Also, the class project acts as a summative assessment of the last three classes.

12.1 Jon Brown, Genetic Disorder PowerPoint

Author: colombiankid3

12.2 Jon Brown, Genetic Disorder Project Assignment

Author: colombiankid3

12.3 Jon Brown, Link to hook video

Author: colombiankid3

http://www.youtube.com/watch?v=8s4he3wLgkM

12.4 Jon Brown, Link to standards for third lesson

Author: colombiankid3

LS1 (9-11) 2b + 2c + 2aa

https://risciencеteachers.wikispaces.com/LS1+p2

12.4 Jon Brown, Weekly Schedule

Author: colombiankid3

Class:

Week:

Topic/Unit:

Date:	Due Today:	Objectives:	Standards:		Acc & Mod:	Homework Assignment:
Day one of Genetic disorder Subunit	N/A	Students will be able to.. - Explain what a pedigree is and what it is used for. - Use a pedigree to make predictions about individuals whose genes are unknown and answer questions regarding the chart.	LS3 (9-11) 7	Hook: Class discussion about past concept and Do-Now Engagement: PowerPoint Presentation and 2 in class worksheets Closure: Hand out homework assignment and exit slip.	Students with disabilities will be allowed extra time to complete worksheets if needed. Students with attention problems will be	- Pedigree worksheet - Also, complete in class worksheet if they did not finish it in class.

					seated in the front row.	
Date: Day two of Genetic Disorder Subunit	Due Today: Pedigree worksheet from previous class. Also, completed in class worksheet if they did not finish it in class.	Objectives: Students will be able to... - Explain what a Karyotype is and what it is used for. - Interpret karyotype charts to tell if someone has a genetic disorder	Standards: LS1 (9-11) 2b + 2aa	Hook: Video segment Engagement: PowerPoint Presentation. The class will be required to create their own karyotype in pairs. Closure: Explanation of online homework assignment and exit ticket	Acc & Mod: Same as above.	Homework Assignment: Completion of online activity. Also, finish karyotype activity if they did not already.
Date: Day three of Genetic Diversity sub-unit	Due Today: Completion of online activity with questions answered on a separate piece of paper. completion of Karyotype activity if it was not completed in class	Objectives: Students will be able to... -Explain what a genetic disorder is and explain what causes them. - Identify several genetic disorders and list a few symptoms of each.	Standards: LS1 (9-11) 2b + 2c + 2aa	Hook: Class discusion on validity of online assignment and video. Engagement: PowerPoint presentation and three part class activity. Closure: Discuss upcoming test and tell students to feel free to come to me for any extra help.	Acc & Mod: Same as above	Homework Assignment: Study for Unit Test Complete in class activity for homework if not finished already.

12.5 Jon Brown Homework Planner

Author: colombiankid3

Day or Date	Homework Assignment	Resources (Links)	Launch Prompt (Why am I doing this?)	Assessment (Next Day)	Assessment (End of Unit or Week)
1	Pedigree Worksheet Finish pedigree worksheet from class.	10.4 Jon Brown, Pedigree Homework	Help students to solidify their understanding of pedigree charts.	Completion of the homework	Genetics Unit Test
2	Karyotype online assignment Finish Karyotype worksheet from class	11.4 Jon Brown, Link to Karyotype Homework Online Assignment	Help students solidify their understanding of karyotypes.	Completion of online activity and bring in paper with answers from activity on it.	Genetics Unit Test
3	Study for Unit Test Finish 3-part class activity	12.2 Jon Brown, Genetic Disorder Project Assignment	Help students prepare for upcoming test	N/A	Genetics Unit Test

12.6 Jon Brown, List of Sources

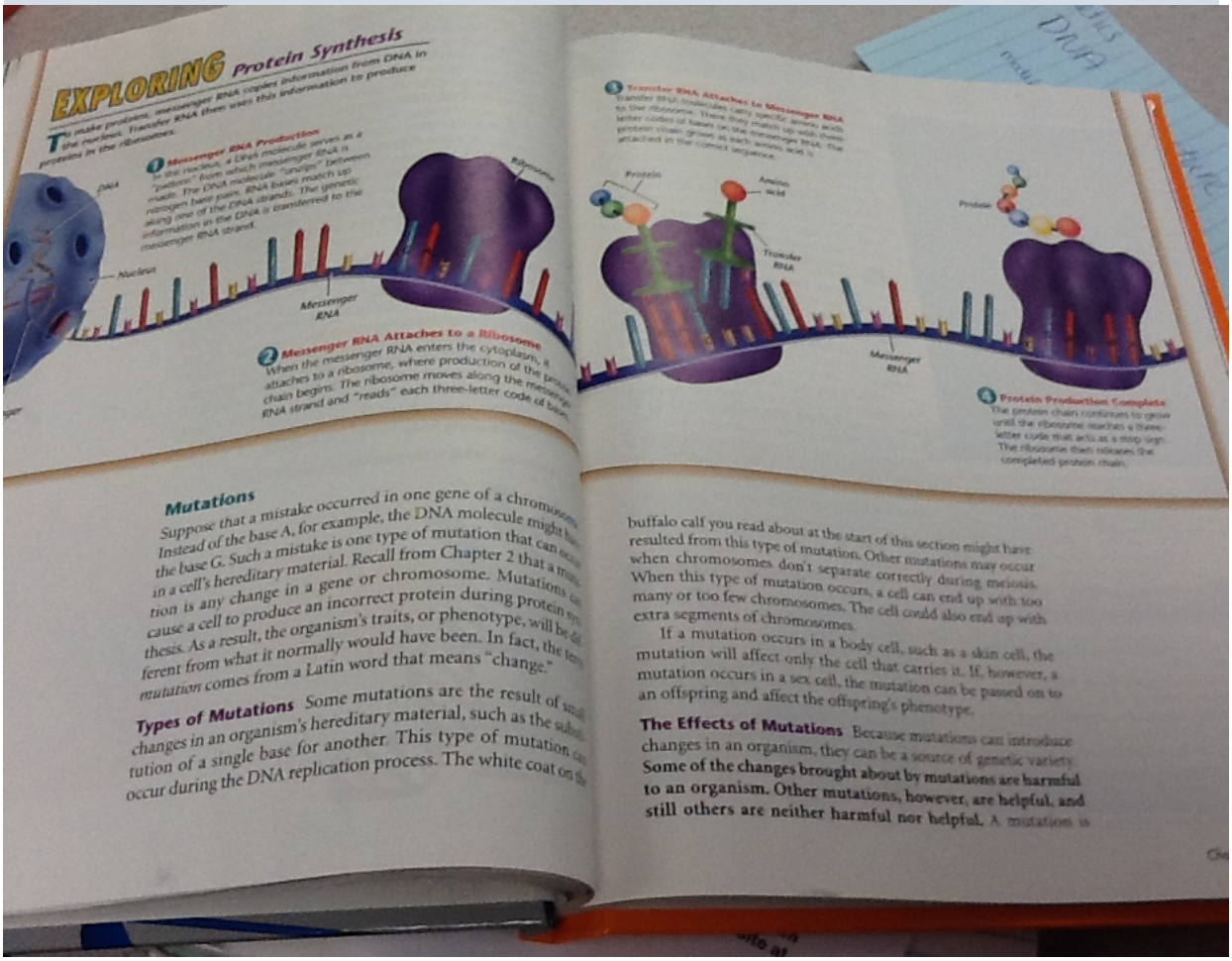
Author: colombiankid3

I used the following sources when designing my lesson plan. Some I only used a tiny bit of, while others I used more extensively.

http://www.classhelp.info/Biology/Genetics/PedigreePracticeProblems1.pdf

http://www.slideshare.net/aus_autarch/pedigree-charts-powerpoint-presentation

Camera roll



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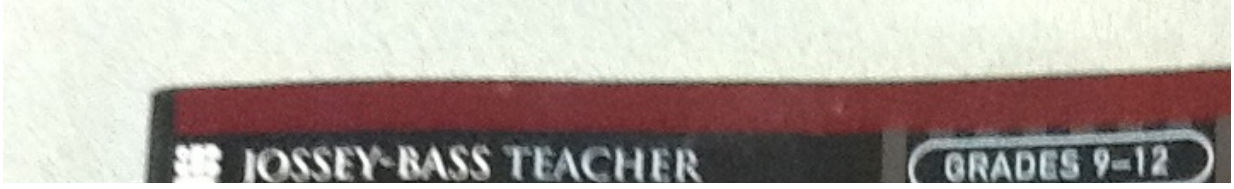
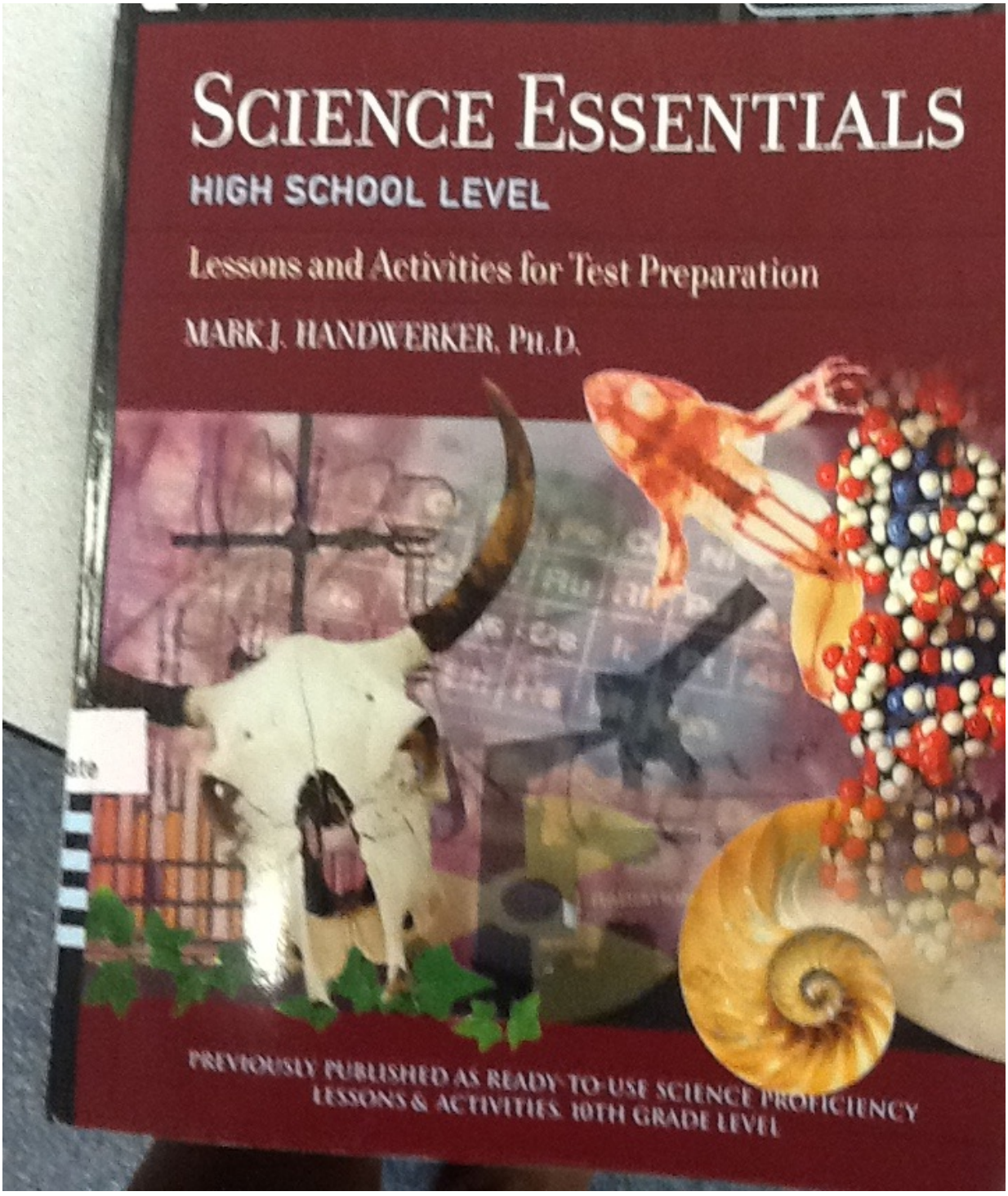
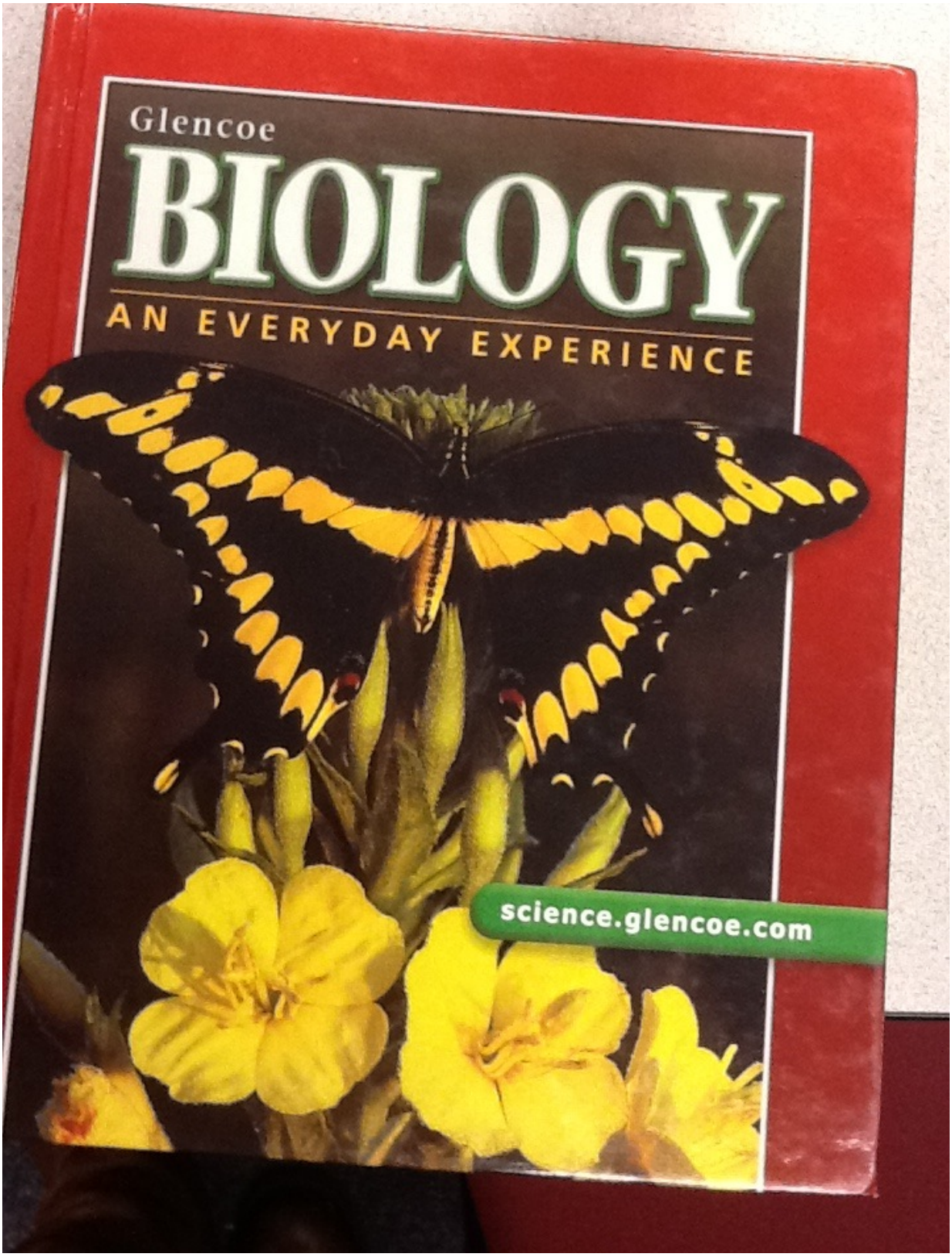



SCIENCE ESSENTIALS
HIGH SCHOOL LEVEL
Lessons and Activities for Test Preparation
MARK J. HANDWERKER, Ph.D.
PREVIOUSLY PUBLISHED AS READY-TO-USE SCIENCE PROFICIENCY
LESSONS & ACTIVITIES, 10TH GRADE LEVEL

Camera roll


Glencoe
BIOLOGY
AN EVERYDAY EXPERIENCE
science.glencoe.com

Chloe Robitaille Weekly Planning Guide

	Monday	Tuesday	Wednesday	Thursday	Friday
Topic		DNA Structure	DNA Structure and Replication	Transcription	Translation/Protein Synthesis
Activity		DNA model building competition	-judge competition -view replication animation	-view Stanford dance -act out transcription -compare/contrast DNA and RNA	-journals -Codon/amino acid problems -project assignment/planning period
Standards		RI GSE- LS1- (9-11) 2a	RI GSE LS1- (9-11) 2a	RI GSE LS1- (9-11) 2cc	RI GSE LS1- (9-11) 2c, 2cc
Things to Collect			-exit slips -DNA models	-exit slips	journals
Homework		Think about how you will present your model	none	none	Think about how you will construct your in-class project
Notes/Reminders	Pass out competition rules			Make copy of completed Venn Diagram for students w/ accommodations	

	Monday	Tuesday	Wednesday	Thursday	Friday
Topic	Translation/Protein Synthesis	Translation/Protein Synthesis			
Activity	Work on project	-Finish projects -Present projects -Protein synthesis wrap up			
Standards	RI GSE LS1- (9-11) 2c, 2cc	RI GSE LS1- (9-11) 2c, 2cc			
Things to Collect	none	projects			
Homework	Think about how you will present your project	Concept map			
Notes/Reminders					

DNA - Chloe

Author: Brittany Barlow

Camera roll

Camera roll
Camera roll
Camera roll

Final Assessment

PDF Attachment

LP01 - Basic Lesson Plan (Replace with Title of Lesson)

Map

Overview

Standards (Links)

Objectives

Students will be able to...

Materials / Preparation Notes

Instruction

Opening

Activities

Closing

Assessment Notes

LP02 - Table-enhanced Lesson Plan (Replace with

Title of Lesson)

Overview

Links to Standards

Materials Checklist

☐
☐
☐
☐

Preparation Checklist

☐
☐
☐
☐
☐

Objectives

Objective	How I will assess during lesson.	How I will assess after lesson.

Opening

--->	--->	--->	--->	
Board Agenda	Starter (on board)	Call to Order/Questions	Day's Goals/Overview	Transition
Housekeeping ==>	☐Greet Students ☐Attendance ☐Collect HW	Upcoming Dates: ==>	☐ ☐	

Instruction

Instructional Step	Teacher Actions/Questions (I will do/say...)	Student Actions/Instructions (Student will...)
1		
2		
3		

Accommodations

Closing

Notes / Resources

LP03 - RIDE Lesson Plan Format

Map

Lesson Title:

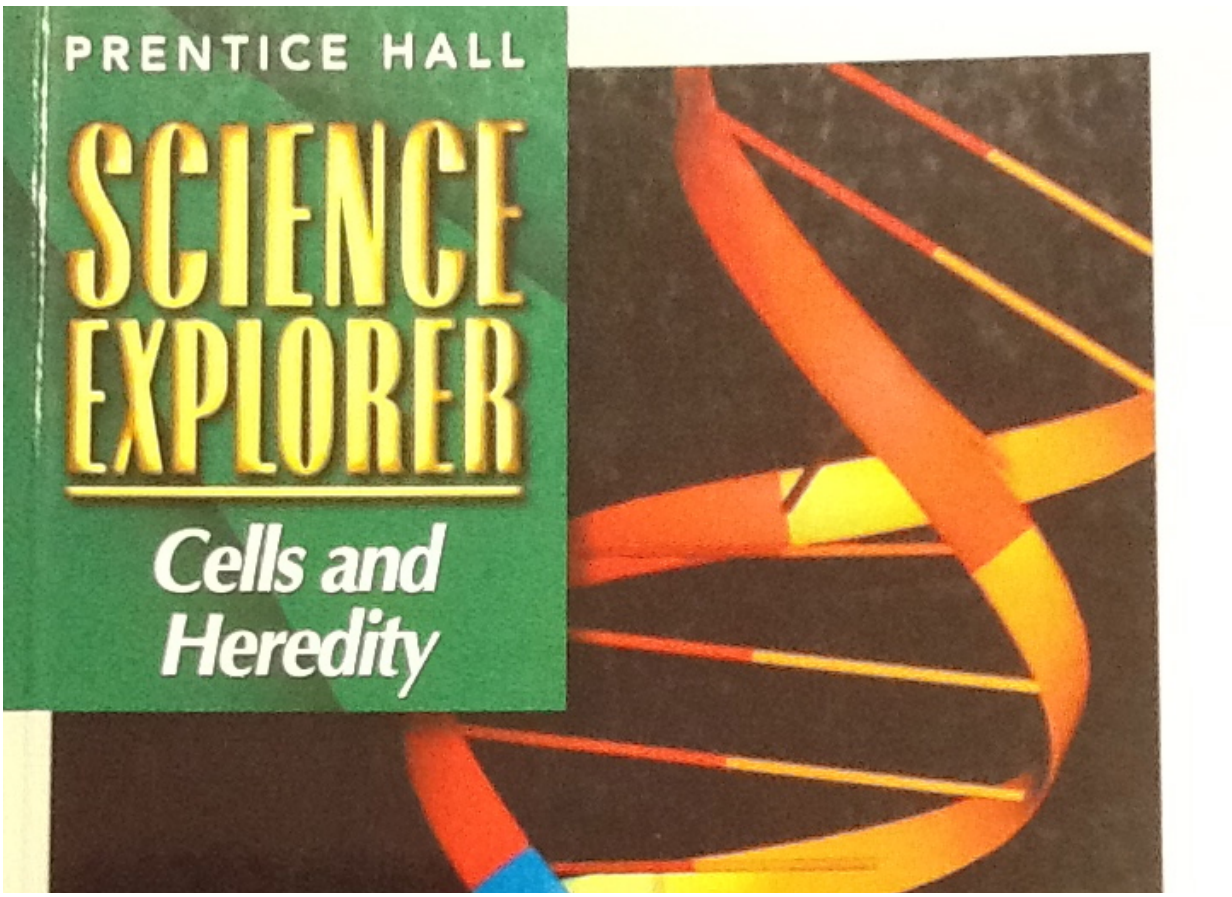
Grade/Content Area	Lesson Plan Content
Lesson Title	
State Standards: GLEs/ GSEs **National Content Standards:**	
Context of the Lesson *Where does this lesson fit in the curriculum and instructional context? Is it the opening of a unit or a series of lessons?*	
Opportunities to Learn *Definition: Materials, Learners and Environments*	**Plans to differentiate instruction:** **Accommodations and modifications:** **Environment factors:** **Materials:**
Objectives	
Instructional Procedures	**Opening:** **Engagement:**

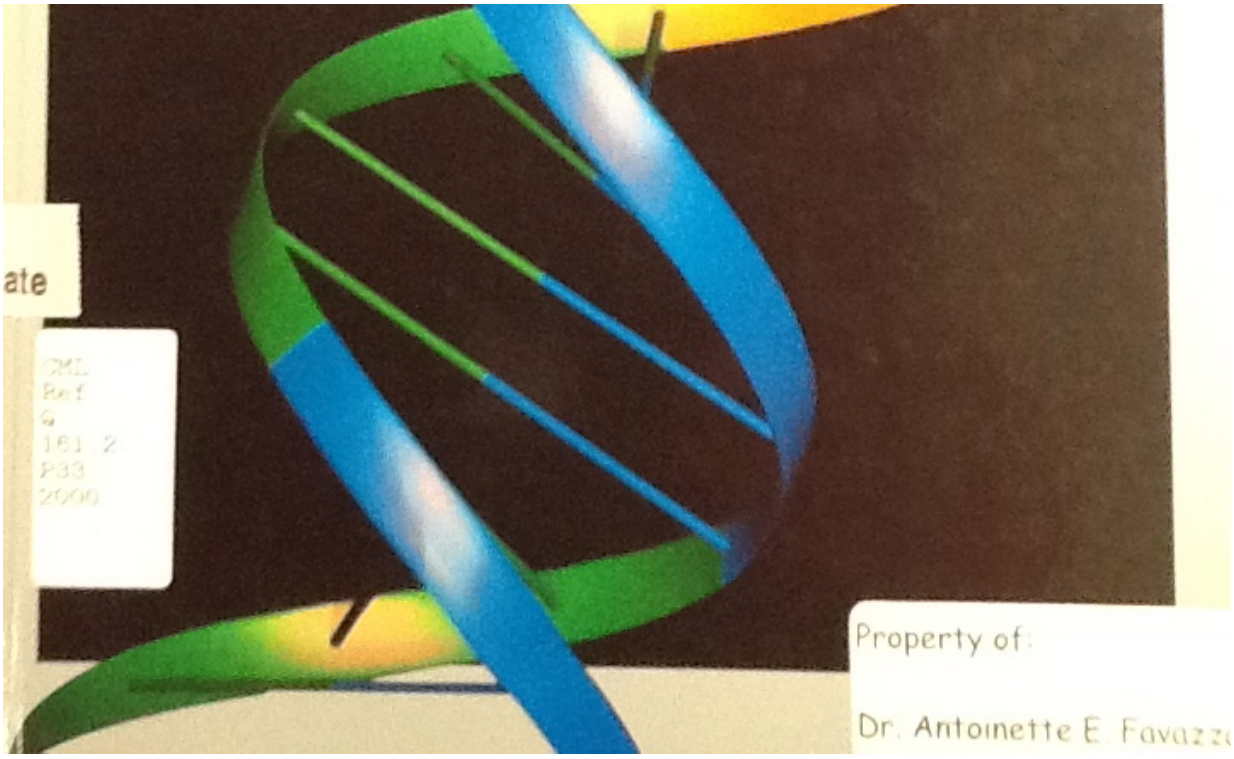
	Closure:
Assessment	
Reflections	**Student Work Sample 1 – Approaching Proficiency:** **Student Work Sample 2 – Proficient:** **Student Work Sample 3 – Exceeds Proficiency:** **Lesson Implementation:**

Mendel - Brittany

Author: Brittany Barlow

Dominant vs. Recessive





Developing Hypotheses

Take a Class Survey

In this lab, you'll explore how greatly traits can vary in a group of people—your classmates.

Problem

Are traits controlled by dominant alleles more common than traits controlled by recessive alleles?

Materials

mirror (optional) PTC paper

Procedure

Part 1 Dominant and Recessive Alleles

1. Write a hypothesis reflecting your ideas about the problem question. Then copy the data table.
3. For trait F, wash and dry your hands. Taste the PTC paper your teacher gives you. Circle either "can taste PTC" or "cannot taste PTC" in your data table. **CAUTION:** *Never taste any substance in the lab unless directed to by your teacher.*
4. Count the number of students who have each trait. Record that number in your data table. Also record the total number of students.

DATA TABLE

Total Number _____

	Trait 1	Number	Trait 2	Number
A	Free ear lobes		Attached ear lobes	
B	Hair on fingers		No hair on fingers	
C	Widow's peak		No widow's peak	

Part 2 Ar

5. Look at the in your dat the eraser small cent free ear lob
6. Look at the eraser is o descriptior your erase a number Share that

Analyze

1. The traits are contro listed und alleles. Wh alleles we students? by recessi

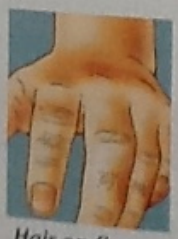
2. For traits A, B, C, D, and E, work with a partner to determine which trait you have. Circle that trait in your data table.

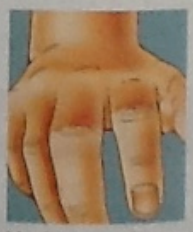
D	Curly hair		Straight hair	
E	Cleft chin		Smooth chin	
F	Can taste PTC*		Cannot taste PTC*	

*PTC stands for phenylthiocarbamide.


Free ear lobe


Attached ear lobe


Hair on fingers


No hair on fingers


Widow's peak


No widow's peak


Cleft chin


No cleft chin

shown by
of student

Principles of Probability

If you did the Discover activity, you used the principles of probability to predict the results of a particular event. Each time you toss a coin, there are two possible ways that the coin can land—heads up or tails up. Each of these two events is equally likely to occur. In mathematical terms, you can say that the probability that a tossed coin will land heads up is 1 in 2. There is also a 1 in 2 probability that the coin will land tails up. A 1 in 2 probability can also be expressed as the fraction $\frac{1}{2}$ or as a percent—50 percent.

If you tossed a coin 20 times, you might expect it to land heads up 10 times and tails up 10 times. However, you might not actually get these results. You might get 11 heads and 9 tails, or 8 heads and 12 tails. Remember that the laws of probability predict what is likely to occur, not necessarily what will occur. However, the more tosses you make, the closer your actual results will be to the results predicted by probability.

When you toss a coin more than once, the results of one toss do not affect the results of the next toss. Each event occurs independently. For example, suppose you toss a coin five times and

Math TOOLBOX

Calculating Percent

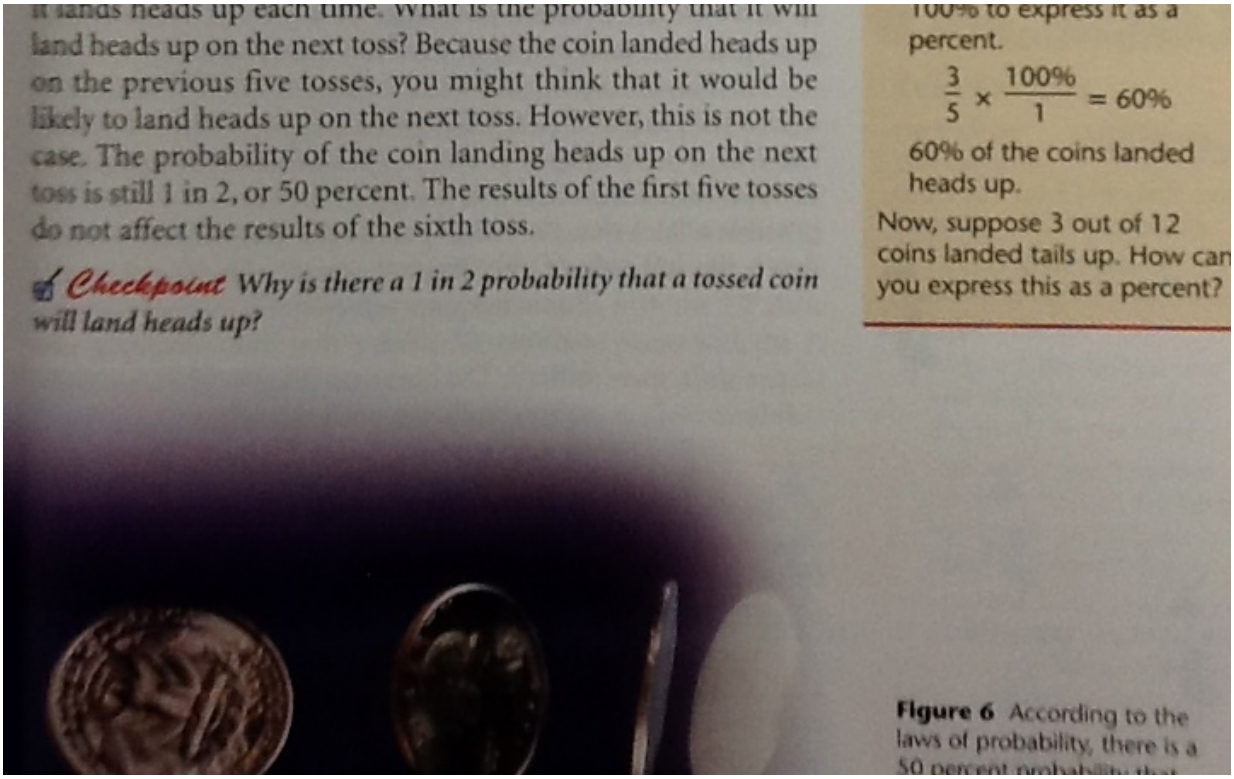
One way you can express a probability is as a percent. A percent (%) is a number compared to 100. For example, 50% means 50 out of 100.

Suppose that 3 out of 5 tossed coins landed heads up. Here's how you can calculate what percent of the coins landed heads up.

1. Write the comparison as a fraction.

$$3 \text{ out of } 5 = \frac{3}{5}$$

2. Multiply the fraction by



lands heads up each time. What is the probability that it will land heads up on the next toss? Because the coin landed heads up on the previous five tosses, you might think that it would be likely to land heads up on the next toss. However, this is not the case. The probability of the coin landing heads up on the next toss is still 1 in 2, or 50 percent. The results of the first five tosses do not affect the results of the sixth toss.

Checkpoint *Why is there a 1 in 2 probability that a tossed coin will land heads up?*

100% to express it as a percent.

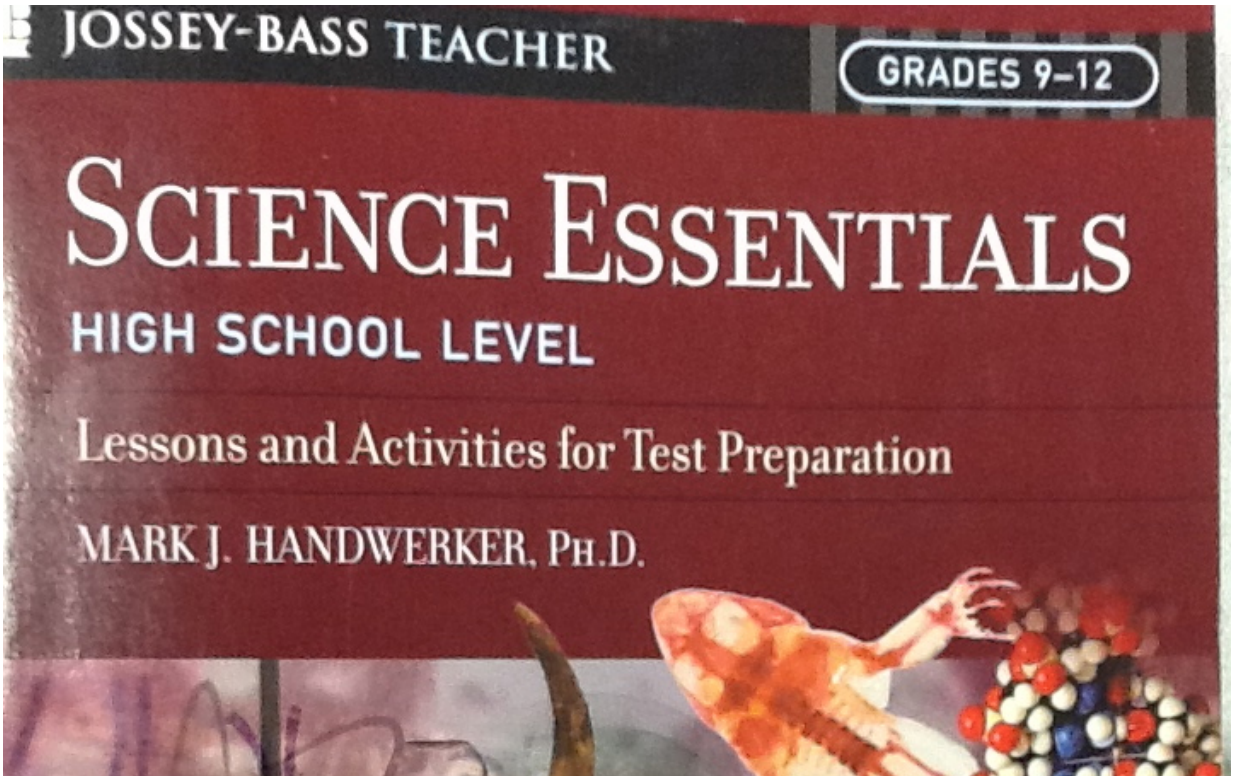
$$\frac{3}{5} \times \frac{100\%}{1} = 60\%$$

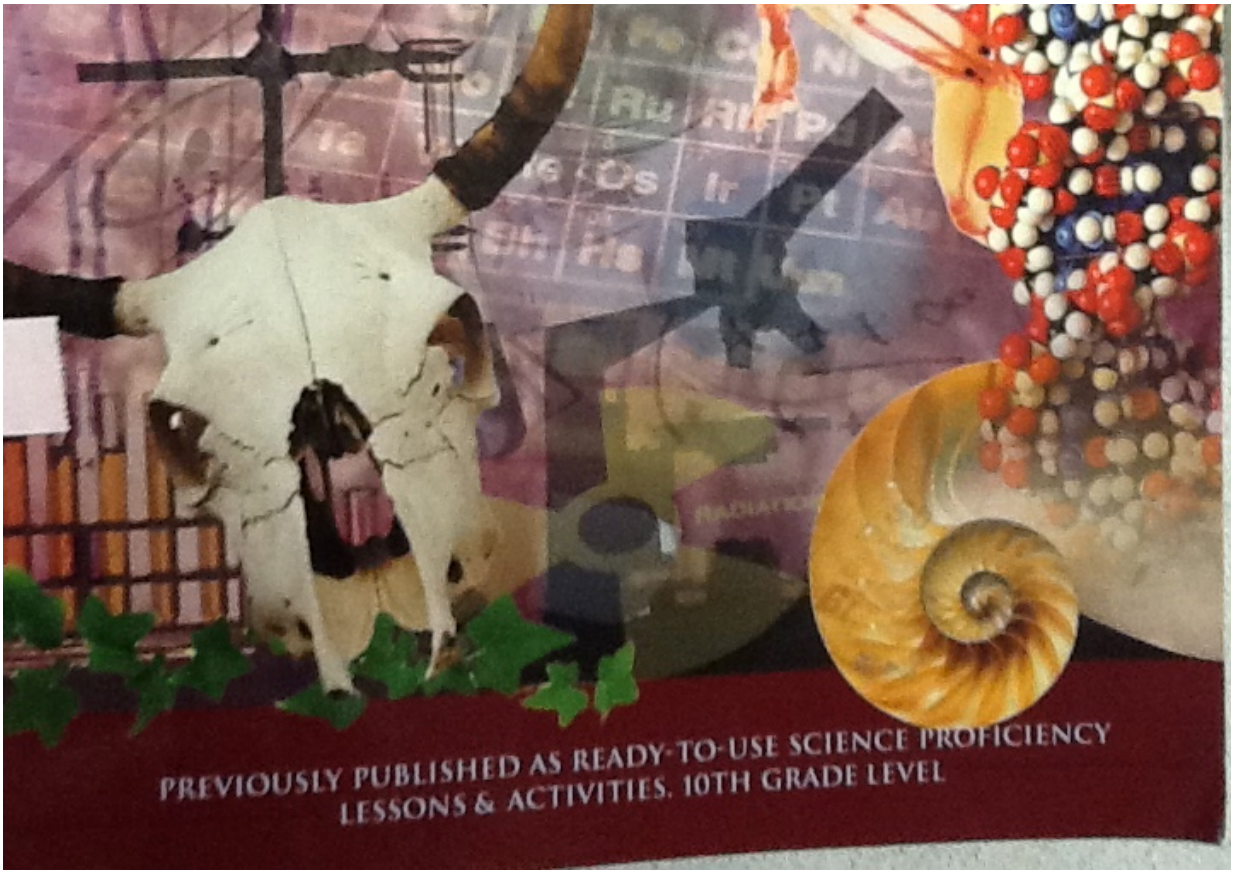
60% of the coins landed heads up.

Now, suppose 3 out of 12 coins landed tails up. How can you express this as a percent?

Figure 6 According to the laws of probability, there is a 50 percent probability that

Independent Assortment





Lesson 21: Teacher Preparation

Basic Principle The phenotype of an organism depends on its genotype which is established at fertilization.

Competency Students will use a Punnett Square to determine the genotypes and phenotypes of an organism resulting from a monohybrid cross.

Procedure

1. Give students time to read the information on *Mendelian Genetics.*
2. Inform students that hybridization in plants was a major curiosity of 18th-century biologists including Carolus Linneaus (1707–1778) who created the binomial system of classification. Linneaus believed that only a few members of every genus had been "divinely created" and that the rest were generated by the "crossing" of slightly different strains. According to Linneaus, hybridization was the basis of variation. Hybridization experiments continued until the middle of the 19th century when they were largely abandoned following Charles Darwin's

(1809–1882) proposal that natural selection was the primary mechanism responsible for the diversity of species. However, Darwin could not account for the mechanism that gave rise to new variations. The practical uses of hybridization continue to this day, however, benefiting horticulturists and agriculturists in the search for new plant and breeding stock variations. In 1865, Gregor Mendel published a report entitled *Experiments in Plant Hybridization* in which he established the basic laws of of inheritance. The key point of his work was the assertion that reproductive cells carried "factors" that embodied the organic characters of living organisms (i.e., the gene concept). Mendel reported that some strains of pea plants bred true to their characteristics. That is, their offspring exhibited characteristics identical to those of the parent. Mendel noted that other strains, however, gave rise to offspring with variations that were a departure from the parents' traits, although they could be found elsewhere in members of related populations. By careful mathematical analysis of the plant populations he hybridized, Mendel was able to determine the statistical probability of producing particular traits in any population of offspring. He had, in effect, discovered the laws that governed the passing of traits from one generation to the next: the laws of heredity.

3. Give students time to complete the activity and the *Observations & Analysis* sections.

Answers to Observations & Analysis

1. See the Punnett Square. The offspring of the first and third plants of the second generation would be 50% hybrid tall and 50% purebred tall.
2. See the Punnett Square. The offspring of the second and fourth plants of the second generation would be 50% purebred short and 50% hybrid tall.

Name _____

MONOHYBRID CROSS OF THE FIRST AND THIRD OFFSPRING OF THE SECOND GENERATION

Genotype of Third Parent: Tt

Possible gametes of Third Parent

Genotype of First Parent: TT

Possible gametes of First Parent

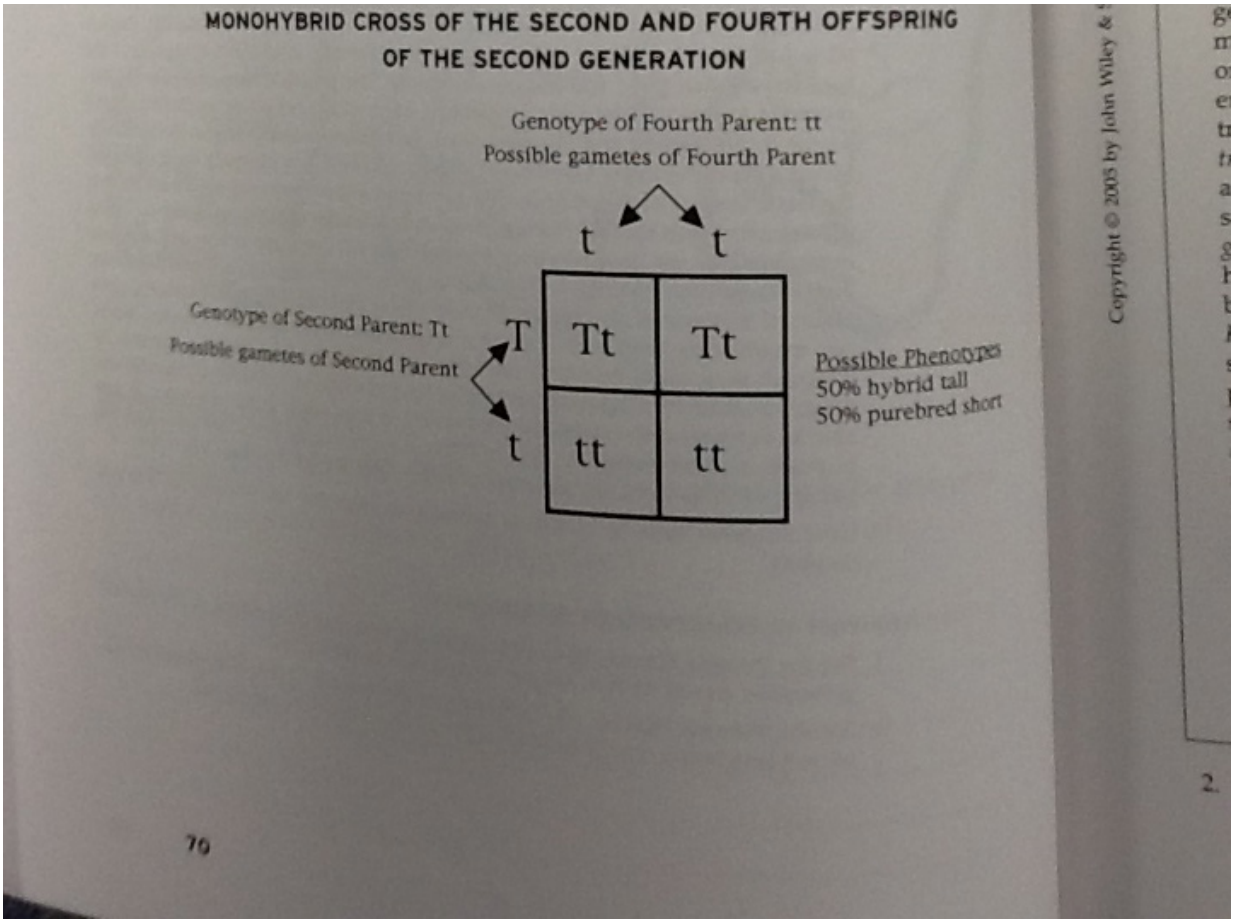
	T	t
T	TT	Tt
T	TT	Tt

Possible Phenotypes
50% purebred tall
50% hybrid tall

Basic
establish

Objec
organis

Proce
1. Re

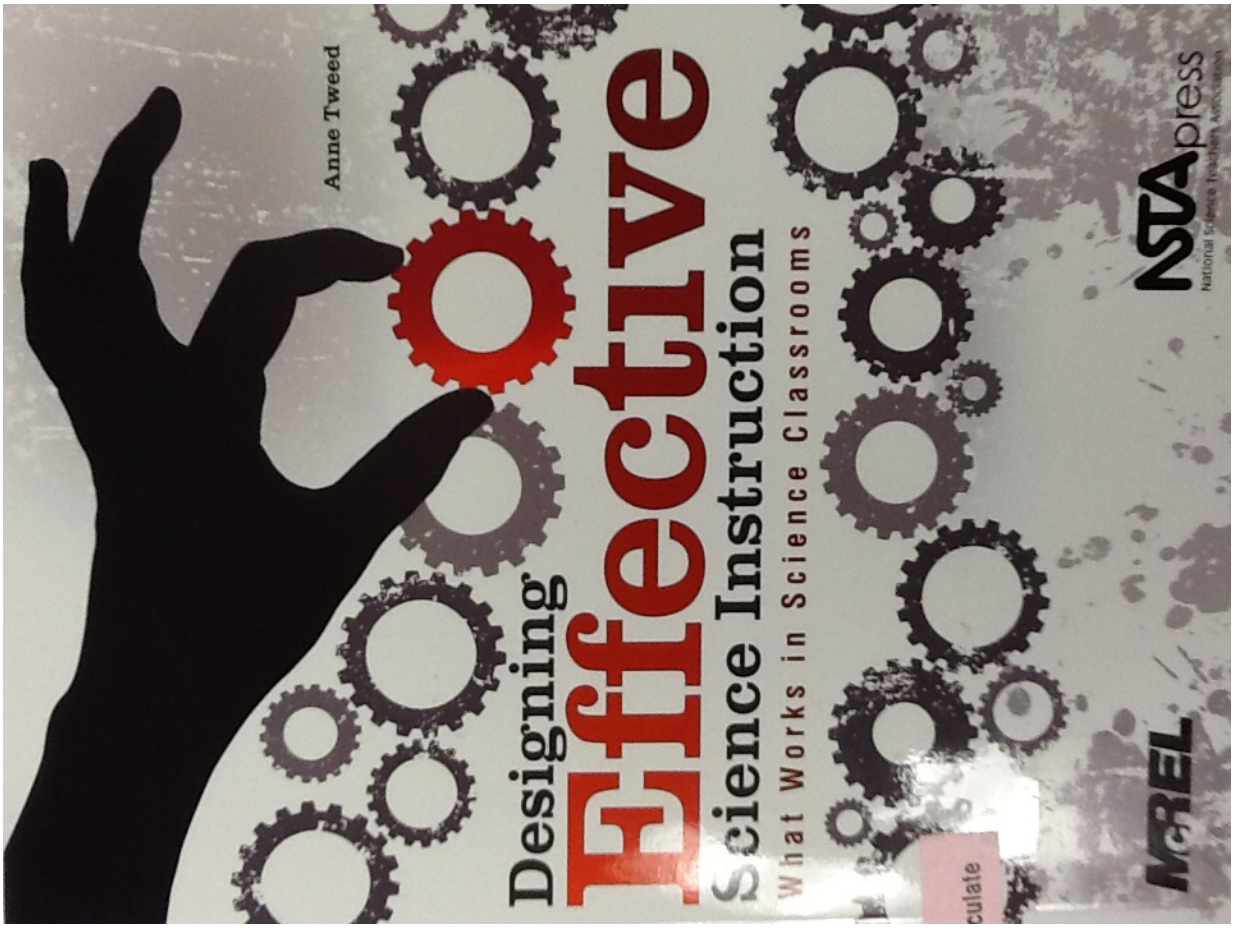


Segregation

Table 2.6
Assessment Methods

Target to be Assessed	Assessment Method			
	Selected Response	Essay	Performance Assessment	Personal Communication
Vocabulary	Multiple choice, true/false, matching, and fill-in can sample mastery of vocabulary.	Essay exercises can tap vocabulary knowledge.	Not a good choice for this target	Can ask questions, evaluate answers, and infer mastery, but may be a time-consuming option
Fact Details	Multiple choice, true/false, matching, and fill-in can sample mastery of facts and details.	Essay exercises can tap knowledge of facts and details.	Not a good choice for this target	Can ask questions, evaluate answers, and infer mastery, but a time-consuming option
Organizing Ideas *Concepts* *Principles* *Generalizations*	Higher-order multiple choice questions can tap organizing ideas to some degree but are not the best choice.	Essay exercises can tap understanding of relationships among elements of knowledge.	Performance tasks that require the use of thinking and reasoning skills can tap understanding of organizing ideas.	Journals, learning logs, interviews, and discussions can provide information about students' understanding of organizing ideas.
Skills	Can assess mastery of the knowledge prerequisite to skillful performance, but cannot rely on these to tap the skill itself	Can observe and evaluate skills as they are being performed (e.g., proficiency in carrying out steps in product development)		Strong match when skill is oral communication proficiency; also can assess mastery of knowledge prerequisite to skillful performance
Reasoning Processes	Can assess application of some patterns of reasoning	Written descriptions of complex problem solutions can provide a window into reasoning proficiency.	Can watch students solve some problems or examine some products and infer about reasoning proficiency	Can ask student to "think aloud" or can ask follow-up questions to probe reasoning
Dispositions	Selected response questionnaire items can tap student feelings.	Open-ended questionnaire items can probe dispositions.	Can infer dispositions from behavior and products	Can talk with students about their feelings

Adapted from Stiggins, R. 1997. *Student-centered classroom assessment*. 2nd ed. Upper Saddle River, NJ: Prentice-Hall.



My First Week

Map

Class:

Week:

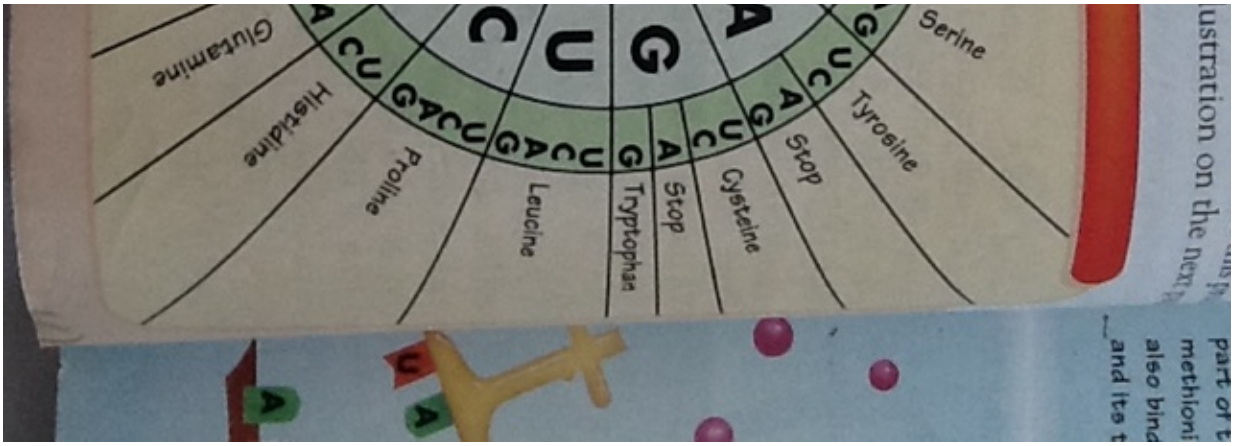
Topic/Unit:

Date:	Due Today:	Objectives:	Standards:	Hook:	Acc & Mod:	Homework Assignment:
Monday, Oct 18 Link Link				Engagement:		

				Closure:		
Date:	Due Today:	Objectives:	Standards:	Hook: Engagement: Closure:	Acc & Mod:	Homework Assignment:
Date:	Due Today:	Objectives:	Standards:	Hook: Engagement: Closure:	Acc & Mod:	Homework Assignment:
Date:	Due Today:	Objectives:	Standards:	Hook: Engagement: Closure:	Acc & Mod:	Homework Assignment:
Date:	Due Today:	Objectives:	Standards:	Hook: Engagement:	Acc & Mod:	Homework Assignment:

				Closure:		

Note



PG02 - Weekly Planning Organizer

[Map]

Class:

Week:

Topic/Unit:

Date:	Due Today:	Objectives:	Standards:	Hook: Engagement: Closure:	Acc & Mod:	Homework Assignment:
Date:	Due Today:	Objectives:	Standards:	Hook: Engagement: Closure:	Acc & Mod:	Homework Assignment:

Date:	Due Today:	Objectives:	Standards:	Hook: Engagement: Closure:	Acc & Mod:	Homework Assignment:
Date:	Due Today:	Objectives:	Standards:	Hook: Engagement: Closure:	Acc & Mod:	Homework Assignment:
Date:	Due Today:	Objectives:	Standards:	Hook: Engagement: Closure:	Acc & Mod:	Homework Assignment:

Sam Barrus Homework Planner

Map

Day or	Homework Assignment	Resources (Links)	Launch Prompt (Why am I doing this?)	Assessment (Next Day)	Assessment (End of Unit or

Date					Week)
1	Vocabulary Breakdown	07/08/09.0 Sam Barrus Res- Word Family Tree Sheet	Help students better understand similar vocabulary	N/A, continues throughout unit, will ask if anyone did one as an example	At least 5 finished sheets to include in the portfolio
1	Gummy Bear Lab	07.4 Res Sam Barrus-Baby Bears Everywhere	Activity to explain non-Mendelian ratios and the spectrum of dominance	See opening prompt for lesson 2	Include lab in portfolio
1	Note Outline	Lesson One Note Outline.pdf	Help students organize concepts on the spectrum of dominance	See opening prompt for lesson 2	Include in portfolio
2	Honors Extension: Article Reflection	08.2 Sam Barrus Res Honors Extension	Honors extension for students above grade level: More information on Thomas Hunt Morgan's work.	May apply to term chosen for next period's discussion	Include in portfolio, specific test question on Morgan
2	Poster and discussion Points	08.4 Sam Barrus Res Discussion Rubric	Having students teach students actively in a full class discussion	Contributions to class discussion	Include See Rubric
3	Bingo Card	09.1 Sam Barrus Res-Genetics Bingo Card	Have students prepared for tomorrow's opener, vocabulary review	Accuracy of matching terms to definitions	Applies to test material
4	Epigenetics Guiding Questions	09.2 Sam Barrus Res-Epigenetics Questions	To guide student's use of the interactive module	Could apply material to an opening prompt	Applies to test material

Weekly Planning Organizer (#3)- Sam Barrus-Beyond Mendel

Map

Class: Biology CP grade 11
Week: 3
Topic/Unit: Beyond Mendel: Non-Mendelian Genetics

Date: Class 1	Due Today: n/a	Objectives: **Students will be able to...** 1. explain the differences between non-Mendelian forms of inheritance 2. distinguish different inheritance patterns through the interpretation of raw data 3. defend their results through representations (graphs, charts, written explanations) of acquired data and statistical analysis	Standards: 07/08 Sam Barrus Content Standard-7b	Hook: Pictures Engagement: video and notes, gummy bear lab Closure: check for understanding, answer questions	Acc & Mod: **ADHD:** quiet work space, role model partner **SLD (reading):** style of lecture/note taking (w/ note outline), integration of discussion into class, vocabulary breakdown worksheets in summative assessment for week 3, reading software for lab if necessary **Physical Disability (mild hearing impairment):** lecture on personal computer with headphones, notes projected to board	Homework Assignment: 1. finish lab packet (typed answers) 2. vocabulary breakdown worksheets (5 required by end of the unit to integrate into study guide)
Date: Class 2	Due Today:	Objectives: **Students will be able to:** 1. differentiate between terminology	Standards: 07/08 Sam Barrus Content	Hook: Mendel is wrong!	Acc & Mod: **ADHD:**front of room seating for reading activity and note taking, to resource center to work on project if desired (will be a computer and a special education teacher to supervise	Homework Assignment: 1. vocabulary breakdown worksheets

		concerning genotypic/phenotypic variation 2. design a poster that provides sufficient information to explain a vocabulary term 3. compare different forms of genetic variation in terms of involved genes and associated phenotypic effects	Standard-7b	Engagement: research and poster designing Closure: to continue lesson next class with discussion and poster presentations	research) **SLD (Reading):**provide hard copy of article to mark with class and on-board mark ups, vocabulary breakdown worksheets integral to summative assessment, presentation graded separately, work with partner for poster project (optional) **Physical Disability (mild hearing loss):**provide hard copy of article with whole class and on-board mark ups, work with partner for poster project (optional)	2. poster and discussion points
Date: Class 3	Due Today: poster and discussion points, reflection for honors	Objectives: continuation of last class's objectives	Standards: continuation of last class's standards	Hook: class structure and organization: set up for our poster session/group discussion, student led Engagement: full class discussion and poster presentation, note taking Closure: Check for understanding, hand out bingo sheets to be filled in for tomorrow	Acc & Mod: continuation of last class's acc/mod	Homework Assignment: 1. vocabulary breakdown worksheets 2. Fill in Genetics Bingo card
Date: Class 4	Due Today: Bingo card	Objectives: **Students will be able to…** **1.**identify environmental factors that contribute to the alteration of DNA **2.**explain why identical twins look more unique as they age **3.**manipulate the epigenome of a rat through an interactive module	Standards: 09 Sam Barrus Content Standard-2b	Hook: Genetics Bingo! Engagement: photo gallery video module Closure: Discussion	**Accommodations and Modifications:** **ADHD**: review instructions to check for understanding, extra time to go over module, work 1:1 with the student often, help organizing of portfolio **Specific Learning Disability (Reading)**: interactive module has much of text following oral instructions, computer to type out responses, video and photos represent key concepts in material **Physical Disability (mild hearing loss)**:	Homework Assignment: Completed subunit portfolio/study guide: 1. notecatcher 2.gummy bear lab 3. at least 5 term vocabulary sheets

				questions and exit slip	able to listen to video on personal computer with headphones for video and interactive module. Speak loudly/clearly (or offer paper copy) when giving instruction, repeat instructions 1:1 to the student while transitioning to new activities.	4. Reflection (honors) 5. Poster shrunk (provided copy) 6. Class discussion web 7. Thought questions